

J.S.

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10/34*

THE ONTARIO

Natural Science

No. 7

BULLETIN

1912



JOURNAL OF THE

Wellington Field Naturalists' Club

GUELPH, - ONTARIO

The Ontario Natural Science Bulletin

JOURNAL OF THE WELLINGTON FIELD NATURALISTS' CLUB
GUELPH, ONTARIO.

AN ANNUAL DEVOTED TO THE FLORA AND FAUNA
OF ONTARIO

Editor—J. EATON HOWITT, M.S. in Agr., O.A.C., Guelph, Ontario.

Associate Editor—T. D. JARVIS, B.S.A., O.A.C., Guelph, Ontario.

Review Editor—A. B. KLUGH, M.A., Queen's University, Kingston, Ontario.

All articles and communications intended for publication should be addressed, Editor Ont. Natural Science Bulletin, Guelph, Ontario.

Books and periodicals for review should be sent to A. B. Klugh, M.A., Botanical Department, Queen's University, Kingston, Ontario.

CONTENTS

The Myxos of Middlesex County	Prof. John Dearness...	3
The Plant Formations of the Bruce Peninsula	A. B. Klugh...	10
Ginseng and its Diseases.....	Prof. Whetzel...	22
The Rosaceae and Leguminosae of Galt, Ontario and Vicinity	W. Herriot...	28
Jungle Life of the Hills of South India.....	G. J. Spencer...	34
Liliaceae of County Peel.....	J. White...	37
The Bartramian Sandpiper Breeds near Guelph.....	Herbert Groh...	38
The Flora of the Sand Dunes of Prince Edward County	A. B. Klugh...	40
Food Habits of the Bullfrog.....	E. W. Calvert...	52
The Edible Toadstools ; The Smooth Lepiota.....	W. A. McCubbin...	53
Weed Migration.....	F. Mitchell...	56
An addition to the List of Toronto Butterflies.....	Arthur Gibson...	58
Notes on the Mammals of Bruce Peninsula.....	A. B. Klugh...	58
The Yellow Breasted Chat at Alma, Ont.....	John Allan, Jr...	60
Notes and Observations.....	Members...	61
Publications received.....	A. B. Klugh...	65
Programme of The Wellington Field Naturalists' Club, 1912.....		76
Officers and Members of the W. F. N. C.....		77

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CYPRIPEDIUM HIRSUTUM IN ITS NATIVE HAUNTS
(See "PLANT FORMATIONS OF THE BRUCE PENINSULA")

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The Myxos of Middlesex.

BY PROFESSOR JOHN DEARNESS, LONDON.

WHY should anyone be interested in the Slime-moulds? Are they of any use? In the ordinary sense of the word—No. Do they injure any useful thing? Excluding the few species of the probably allied Phytomyxineae they are not injurious to anything of economic importance.* But if beauty is its own excuse for being, they certainly have a valid *raison d'être*; and if forcing upon thoughtful minds problems that are at once unique, interesting and difficult is a mental stimulant, then they may share a claim to utility with those plants that provide satisfaction for the physical appetite.

These organisms, Myxomycetes, or Myxogasters, or Mycetozoa—Myxos will do for short—what are they anyway? Are they plants or are they animals? Some biologists say Both; others say Neither. But paradoxical as it may seem it is hardly disputed that they are animals in their vegetative stage, called the plasmodium, and plants in their reproductive stage, called usually the sporangium. The reader is probably familiar with the form and movements of the common amoeba. Let him imagine a coalescence of a swarm of amoebae—a plasmodium—rhythmically flowing hither then thither, creeping in and out among the interstices of rotting wood, decaying straw or other organic substances—selecting, engulfing, and digesting suitable food materials; spreading out when food runs low to discover pastures new, and passing a message along the lines when the discovery is made to gather in a mass at the table.

* *Usu in vita communi parum admodum sese commendant, sed in oeconomia naturae certe non spernendi. Multa insectorum genera ex eorum sporidiis unica capiunt nutrimenta.* FRIES *Systema Mycologicum* III, p. 74.

For the reason already stated, this assembling and feasting is usually concealed but in the history of the majority of these plasmodia there comes a stage of maturity or a condition of environment of the plasmodia moving them to enter a protected resting state or to emerge into the open air to spread over the surface of the matrix or to climb up the sides of contiguous plants or stems where they pass into aethalia or sporangia and become masses of dusty spores.

To the transitional stage, often a quite conspicuous one resembling beaten egg, or dirty honey or blood stained mucilage, the novice is more apt to experience aversion than any other feeling. It was this stage that suggested their commonest name—slime-moulds. But let him wait—I was going to say a minute—to observe the wonderful transformation. Different species follow different methods. Some of them build spore houses of many adjoining rooms, others spread out and in separated plasmodia develop into little tops or balls or lenses the prettiest conceivable, and still others creeping up leaves of grass or stems of plants or sides of stumps or trees resolve into rows of almost microscopic puff-balls. Many of them are more beautiful than the uninitiated can imagine until they have examined with the microscope the iridescence of their walls or the delicate lacework of their internal structure. After making such an examination the mind must be a dull and unimaginative one indeed if it does not become curious to know something of the life-history of these beautiful and curious little animal-plants.

It would make too long a story to summarize here the observations of De Bary, Cooke, Schroeter and many other students of the order. I can specially commend to readers who have access to the *Annals of Botany* a paper by Arthur Lister in Volume II, 1888. Anyone who begins to read the article will surely peruse it to the end. That observer kept plasmodium of a species of *Badhamia* under fairly continuous observation for a year at a time. One might almost say he trained it to come to be fed. He found out at least certain kinds of food it preferred to other kinds. A plasmodium that he had confined several days in a glass box had spread itself out over the clean glass in a widely meshed network of narrow lines. "To a point", he writes, "on the upper edge of the net-work I applied a thin pulp of the scraped hymenium of *Stereum* (a common fungus). There was at

first, as I have not infrequently seen, a shrinking backwards of the margin of the network, as if notice of the presence of a food-supply had been sent off to the more distant parts; then came on a quick stream and in a quarter of an hour the whole side was pouring up its plasmodium with astonishing rapidity. The wide meshwork was not sufficient to conduct the abundant supply and fresh veins started off in all directions . . . they rushed across the field of the microscope at a speed that was truly amazing . . . New veins were crossing and recrossing the wide network in every direction and in a few minutes it was converted into a film of rapidly moving plasmodium, perforated with small openings ending in an opaque mass which overspread the food-pulp . . . It was a sight not soon to be forgotten; the marvellous exhibition of such active life in so low an organism was most impressive."

Once a start in the study of these forms is made, the student who is moderately expert in the use of the microscope will find it more interesting to observe the organisms themselves than to read about them. In the season, say from July or August until October, it is safe to say that there is not a ten-acre block of mixed woods in this Province which will not afford the seeker one to several interesting species. At a meeting of the Microscopical Section I once had the pleasure of exhibiting eight species that I found on a single decaying basswood.

My own collection contains over a hundred kinds but the following list includes only those collected in the townships of the eastern half of the county. To these are to be added several species not yet satisfactorily determined. The majority of those named were at some time submitted to the late Mr. J. B. Ellis, the late Mr. A. P. Morgan or Dr. Peck for correction or verification. Bibliographical assistance on the taxonomy was obtained chiefly from Fries "Systema," De Bary's "Mycetozoa," Peck's Reports, Morgan's "Myxomycetes of the Miami Valley," and McBride's "Myxomycetes of Eastern Iowa."

The names employed are chiefly Rostafinski's as these seem to be in most common use. It is said that the application of the law of priority would displace most of them. Some of the common species carry a score or more of synonyms; *Physarum sinuosum*, for example, has twenty-six and *Fuligo varians* twenty-seven.

It may be said to the intending collector that the sporangial stage is as easily preserved as the mosses. A layer of the wood or stratum upon which the sporangia form must be lifted with them and when this becomes dry it may be glued into the top or bottom of a shallow pill-box. Care has to be taken in most cases to avoid the crushing of the extremely delicate fructifications. The few that happen to be too tall for a $\frac{1}{4}$ to $\frac{3}{8}$ inch pill-box may be glued in with their sides parallel to the bottom of the box. In the herbarium I have never seen them attacked by insect pests.

The MYXOMYCETES are a group of organisms of obscure genetic relationship. They may be characterized in brief as fungus-like organisms destitute of mycelium, producing from resting spores amoeba-like swarm-spores which increase by division and finally aggregate or fuse into masses of protoplasm called plasmodia which develop resting-spores. By many they are regarded as animals and are called "Mycetozoa."

They are usually classified into one order of parasites on living plants and two orders of saprophytes—the Acrasieae consisting of incompletely fused zoospores and Myxogasters in which the plasmodium consists of completely fused zoospores.

Species of the last order only are named in the following list :

Spores exposed : No. 1.

1. *Ceratiomyxa mucida* (Pers.), white or watery-white ; no mycelium. Common on wet, rotten wood in hot weather.

Spores enclosed in sporangia : Nos. 2-51.

Lacking capillitium : Nos. 2-7.

2. *Licea biforis*, Morgan, n. s. I found this on dead black ash near Granton in 1892, and sent it to the late A. P. Morgan who published the description in the following year. The sporangia, but for the color, which is bright yellow-brown, suggest the oyster-shell bark-louse. The dark yellow, globose spores are 10-11 microns in diameter.

3. *Licea variabilis*, Schrad. Dull red to black, spores yellow, rough, 14 mic.

4. *Tubulina cylindrica*, Bull. Spores rusty. The aethalium which may be as large as a dime or larger passes through a bright red stage which is very attractive.

5. *Lindbladia effusa* (Ehr.) A doubtful determination.
6. *Enteridium rozeanum*, Wingate. Aethalia large $\frac{1}{2}$ -1 $\frac{1}{2}$ inches broad, shining, brown ; occasionally common.
7. *Dictydium umbilicatum*, Schraed. A delicate species, 2 mm. high. The thin parts of the wall break away, leaving the spores in a pretty little stalked basket.

Possessing capillitium—more or less complicated, sometimes very beautiful network that lines the walls of the peridium or traverses its interior—Nos. 8-51.

Lacking both columella and lime deposits—Nos. 8-30.

Capillitium even, not thickened—Nos. 8, 9.

8. *Perichaena corticalis*, Batsch. Like half-ripe small mustard seed, under the lens a beautiful species. My specimens are all on black ash bark. Spores yellow.

9. *Perichaena depressa*, Lib. Peridia larger, flatter and more irregular than No. 8.

Capillitium thickened irregularly—Nos. 10-19.

10. *Oligonema nitens*, Lib. Shining, crowded, minute sporangia. Not rare.

11. *Oligonema brevifilam*, Peck. Very short elaters.

12. *Lachnobolus* (may be *circinatus*, Schraed). Capillitium springing from the walls of the peridium.

13. *Arcyria punicea*, Pers. Not rare. Conspicuous by its color, often bright red. A small, ovoid sporangium raised on a 2 mm. stipe.

14. *Arcyria cinerea*, Bull. Capillitium rises out of the ruptured peridium as a pale or ashy-yellow network.

15. *Arcyria pomiformis*, Roth. Spinulous capillitium.

16. *Arcyria nutans*, Pers. Cylindric ; long yellow plume-like capillitium. Common.

17. *Arcyria incarnata*, Pers. Crowded ; capillitium pink.

18. *Lycogala epidendrum*, Buxb. The best known myxo. It emerges from decaying wood in scarlet masses from the size of a pea to a small marble, turning gray-brown as it matures, and finally scattering its spores after the manner of a puff-ball.

19. *Lycogala exiguum*, Morgan. Small, minutely scaly. Found only once.

Capillitium (elaters) spirally thickened—Nos. 20-30.

20. *Trichia fallax*, Pers. Shining, olive-brown, stipitate, pear-shaped; Spores and elaters yellow,

21. *Trichia varia*, Pers. Pale, variable in size, two spirals on smooth elaters. Very common.

22. *Trichia chrysosperma*, Bull. Elaters and spores in mass golden yellow. Common.

23. *Trichia affinis*, De Barry. Elaters spinulose banded, enlarged behind the acute tips. Spores angular.

24. *Trichia incarnata*, Pers. The reddest *Trichia* in the collection.

25. *Trichia scabra*, Rost. Elaters long, spinulose, yellow.

26. *Hemiarcyria rubiformis*, Pers. Ruby-red or brownish-red throughout—plasmodium, sporangium, capillitium, spore-mass. A common and attractive species.

27. *Hemiarcyria Ellisii*, Mass. Similar to No. 26; spores rougher.

28. *Hemiarcyria serpulæ*, Scopoli. Vermiform, bright yellow, not rare in the early fall.

29. *Hemiarcyria clavata*, Pers. Sporangia somewhat pear-shaped, or club-like; stipitate yellow.

30. *Hemitrichia vesparium*, Batsch. Similar to No. 26 but sessile and the threads are yellowish.

Possessing columella—an extension of the stipe into the sporangium—lacking lime deposits; capillitium not tubular—Nos. 31-35.

31. *Reticularia umbrina*, Fr.—*R. Lycoperdon*, Bull. Externally similar to No. 6.

32. *Comatricha typhina*, Rost. Peridium disappears. Branching columella and capillitium rise in delicate vertical plume. Spores violet.

33. *Stemonitis fusca*, Rottr. This and the next raise into the air their beautiful, delicate, sometimes nodding plumes.

34. *Stemonitis maxima*, Schw.

35. *Stemonitis ferruginea*, Ehr. The stipe looks like a bit of maidenhair stem. Spores brown. Mr. Ellis named a very similar specimen which I collected at Ilderton, *Stemonitis herbatica*, Peck.

Lime deposits in other parts but not in capillitium: columella present—Nos. 36-37.

36. *Diachaea leucopoda*, Bull. Beautifully tinted sporangia on white stipes. Spores violet.

37. *Spumaria alba*, Bull. The whitish, slimy plasmodium often seen strung along grass stems, changing at maturity into bluish gray or blackish masses of spores.

Lime crystals in the capillitium; columella inconspicuous or absent—Nos. 38-42.

38. *Didymium farinaceum*, Schrad. Sporangium deeply umbilicate at base; stipe dark.

39. *Didymium squamulosum*, A. and S. Wall carrying a layer of lime crystals; stipe white.

40. *Chondrioderma spumarioides*, Fr. Lime-covered wall, sessile; spores violet.

41. *Chondrioderma crustaceum*, Peck. Outer limey wall separable from inner iridescent one. Spores very dark-violet.

42. *Chondrioderma Michellii*, Lib. Umbilicate below, sometimes above also; the stipe standing on a circular disc.

Capillitium and usually walls with non-crystallin lime deposits: spores violaceous—Nos. 43-51.

43. *Cienkowskia reticulata*, A. and S. Capillitium with hooked branchlets. Spores violet.

44. *Tilmadoche viridis*, Gmelin. Sporangium nodding, flattened, greenish yellow.

45. *Leocarpus fragilis*, Dicks. Sporangia look like smooth, brownish insect eggs attached by their ends to white, short, thread-like stems.

46. *Craterium leucocephalum*, Pers. Sporangia little cups with a flattish lid-like covering. Mostly on dead leaves.

47. *Craterium minimum*, B. and C. Minute, whitish to yellowish cylinders or deep wine cups with convex, circumcissile lid. Common.

48. *Physarum nutans*, Pers. Lenticular sporangia on relatively long bent or top-curved stipes.

49. *Physarum cinereum*, Batsch. Sporangia sessile, relatively large.

50. *Physarum sinuosum*, Bull. The sinuous, ashy-gray, fructification suggests a miniature fort. It is said to be rare but I have observed it quite frequently.

51. *Fuligo septica*, (L.) Gmelin—*Fuligo varians*, Sommerf. This seems to include *Fuligo rufa*, *F. violacea* and *F. flava*. Its yellowish or reddish plasmodium—"flowers of tan"—is the most conspicuous one in the list. I have seen a decaying stump end nearly covered with it, spreading in an irregular circle eight to ten inches in diameter like a thick, rough omelet. In some parts of the county the children used to call it "snake-poison." It matures into a mass of purplish black spores. When these are scattered by the wind there is left a noticeable hypothallus marking the area covered by the spore mass.

The Plant Formations of the Bruce Peninsula.

By A. B. KLUGH, M. A., Queen's University, Kingston, Ont.

THE Bruce Peninsula lies between Lake Huron and Georgian Bay. It is composed of limestone of the Clinton, Niagara and Guelph formations, the Clinton forming high bluffs on the Georgian Bay side. Towards the base of the Peninsula, the Lake Huron shore is low and sandy, becoming more rocky to the north. Near the base are several small lakes, some of which are connected into a chain by rivers.

Phytogeographically the flora is an interesting one, for while it is in the main Alleghanian there are some Carolinian (southern) forms on the western shore, and also some western forms on this shore and at other points on the Peninsula.

The field work upon which these notes are based extended over a period of six years and included all seasons of the year from April to January. This work may be divided into two parts—first a

preliminary survey of the whole Peninsula from Tobermory at the north to the base in which notes were made of all species found—second, an intensive study of small areas of typical formations.

HYDROPHYTIC FORMATIONS

PLANKTON FORMATION

This formation is most abundantly developed in the spring in ponds, swales and at the edge of the small lakes. A swale near Colpoy's Bay on May 20th contained the following forms of Algae :—

Merismopedium glaucum, *Ophiocytium cochleare*, *Ophiocytium parvulum*, *Chlamydomonas globosa* and *Rhaphidium falcatum aciculare*. Another swale near Colpoy's Bay on June 5th contained the following phytoplankton :—*Chlamydomonas communis*, *Chlamydomonas globosa*, *Pandorina morum*, *Volvox aureus*, *Rhaphidium falcatum*, *Nephrocytium agardhianum*, *Scenedesmus obliquus*, *Scenedesmus quadricauda*, *Coelastrum proboscideum* and *Pediastrum boryanum*.

Floating at the windward shore of Sky Lake on May 28th were the following forms :—*Microcystis marginata*, *Coelosphaerium kuetzingianum*, *Merismopedium glaucum* and *Pediastrum boryanum*.

PLEUSTON FORMATION

This formation consists of plant forms larger than those composing the Plankton which are free-floating. It exists in much the same situations as the Plankton formation, but exhibits greater variety as to the species of Algae which enter into its composition in different ponds and swales. A swale near Boat Lake had the following representatives of this formation :—*Conferva bombycina* and *Spirogyra varians*. A swale near Golden Valley had *Conferva bombycina*, *Mougeotia genuflexa* and *Draparnaldia glomerata*. A swale near Colpoy's Bay had *Hydrodictyon reticulatum* and *Oedogonium capilliforme*, and at the margin of Lake Isaac there were *Zygnema leiospermum* and *Mougeotia scalaris*.

LIMNO-NEREID FORMATION

This formation includes those Algae which are attached to stones and rocks in lakes, pools and streams. Along the shore of Georgian Bay this formation is represented solely by *Ulothrix aequalis* and *Ulothrix zonata*. The two species grow in separate patches and the former is of a darker green than the latter. Gametes of *Ulothrix aequalis* were mature on April 30th.

In a stream from a spring at Colpoy's Bay, *Tetraspora lubrica* was common. In a stream near Colpoy's Bay were *Batrachospermum moniliforme* and *Oscillatoria formosa*, and in another stream near Colpoy's Bay was *Cladophora callicoma*.

A quite different association of this formation is found in rock-pools. In a rock-pool in a limestone point at Oliphant the stones were coated with gelatinous nodules of *Gleocapsa rupestris* and *Scytonema myochrous*.

LIMNAEA FORMATION

This includes hydrophytes which grow with their roots in the soil at the bottom. It is best developed in the slow-flowing rivers with muddy bottoms which connect some of the lakes near the base of the Peninsula, though even here its development is not extensive. At the bridge over the Pattanelly River the following occurred:—*Castalia odorata*, *Potamogeton heterophyllus* and *Potamogeton pectinatus*. At the margin of Spry Lake were *Najas flexilis* and *Potamogeton heterophyllus*.

HELOPHYTIC FORMATIONS

REED-SWAMP FORMATION

This formation while it does not cover extensive areas in any one place, occurs at many points along the margins of lakes and streams throughout the Peninsula.

Between the shore and the bog at Oliphant there is an almost continuous line of little marshes which had the following flora:—*Equisetum palustre*, *Triglochin palustris*, *Triglochin maritima*, *Phalaris arundinacea*, *Muhlenbergia glomerata*, *Calamagrostis canadensis*, *Poa triflora*, *Glyceria nervata*, *Scirpus americanus*, *Scirpus validus*, *Eleocharis acuminata*, *Eleocharis rostellata*, *Cladium mariscoides*, *Rhynchospora alba*, *Carex hystericina*, *Carex aquatilis*, *Carex filiformis*, *Carex polygama*, *Carex castanea*, *Carex granularis*, *Carex flava*, *Carex oederi*, *Carex aurea*, *Carex vulpinoidea*, *Carex interior*, *Carex bebbii*, *Juncus balticus littoralis*, *Juncus tenuis*, *Juncus canadensis*, *Proserpinaca palustris*, *Castilleja coccinea*, *Lysimachia terrestris* and *Lobelia kalmii*.

Along the Pike River near the bridge the following species occurred:—*Pontederia cordata*, *Eleocharis palustris*, *Sparganium americanum androcladum*, *Glyceria fluitans* and *Equisetum fluviatile*.

BUSH-SWAMP FORMATION

This is developed along streams, at the borders of lakes and in swales. In a swale at Colpoy's Bay the dominant shrubs were *Salix rostrata*, *Salix discolor* and *Salix lucida*, beneath these grow *Aspidium thelypteris*, *Onoclea sensibilis*, *Glyceria nervata*, *Carex stipata*, *Carex vulpiniodea*, *Epilobium adenocaulon*, *Cicuta maculata*, *Eupatorium purpureum* and *Eupatorium perfoliatum*.

Inside the Reed-swamp formation along the Pike River is Bush-swamp formation composed of the following:—*Alnus incana*, *Cephalanthus occidentalis*, *Myrica gale*, *Equisetum fluviatile*, *Osmunda regalis*, *Calamagrostis canadensis*, *Leersia oryzoides*, *Carex aquatilis*, *Carex lupulina*, *Eleocharis acicularis*, *Alisma plantago-aquatica*, *Dulichium arundinaceum*, *Asclepias incarnata*, *Mimulus ringens*, *Sium cicutaeifolium*, *Lobelia cardinalis* and *Menyanthes trifoliata*.

OXYLOPHYTIC FORMATIONS

HIGH-MOOR FORMATION

This formation includes those areas usually termed bogs and while such areas are not common on the Peninsula they are extremely well developed at three points namely, at Oliphant and at Golden Valley, on the Lake Huron Shore and at Mud Lake in the interior of of the Peninsula.



Fig. 1—SECTION OF BOG AT OLIPHANT.

(Photo by KLUGH).

The bog at Oliphant is particularly interesting as it is an example of an area undergoing a comparatively rapid change. Even in the six years during which I have had this locality under observation, it has become much drier. This is probably due to the steady falling of the water in Lake Huron as this bog is situated between the sand hills and the lake. The *Sphagnum*, the basis of high-moor formations appears to be dying out, and in many parts of the bog plants which usually inhabit drier locations, as *Linum medium*, *Carex eburnea*, *Aster ptarmicoides* and *Solidago canadensis* are coming in.

The trees in this bog are mainly *Larix laricina*, and *Thuja occidentalis*. The shrubs are *Hypericum kalmianum* and *Potentilla fruticosa*. Fig. I shows a section of this bog on the landward side. In addition to the species already mentioned the following constitute the flora of the Bog:—*Equisetum palustre*, *Selaginella selaginoides*, rare and confined to a very limited area, *Juniperus horizontalis*, *Triglochi palustris*, *Triglochin maritima*, *Eriophorum viride-carinatum*, *Scirpus caespitosus*, *Eleocharis acuminata*, *Carex filiformis*, *Carex castanea*, *Carex polygama*, *Carex livida*, *Carex leptalea*, *Carex capilla elongata*, *Carex interior*, *Tofieldia glutinosa*, *Smilacina stellata*, *Zygadenus chloranthus*, *Iris lacustris*, *Sisyrinchium mucronatum*, *Cypripedium hirsutum*, *Cypripedium parviflorum pubescens*, *Habenaria hyperborea*, *Calopogon pulchellus*, *Spiranthes romanzoffiana*, *Sarracena purpurea*, *Drosera rotundifolia*, *Drosera linearis*, *Parnasia carolinensis*, *Primula mistassinica*, *Arctostaphylos uva-ursi*, *Moneses uniflora*, *Saxifraga glabra*, *Gerardia paupercula*, *Castilleja coccinea*, *Utricularia flexuosa*, *Utricularia cornuta*, *Lobelia kalmii*, *Solidago riddellii* and *Clivia tuberosa*. The occurrence of the two latter species is interesting as both are plants whose range lies to the south-west of Ontario and they further illustrate a south-western tendency shown by other members of the flora and by the fauna of the Bruce Peninsula.

In the bog at Golden Valley *Sphagnum* is abundant and dense and it will be seen that many species which are apparently recent arrivals from drier ground in the Oliphant bog are absent. The following is the flora of a section of this bog examined on June 1st. Undoubtedly later in the season other species would be found. *Equisetum palustre*, *Primula mistassinica*, *Corallorhiza striata*, and *Pyrola rotundifolia incarnata*. These four species were found along the landward edge

of the bog. Further out in the bog were :—*Juniperus horizontalis*, *Larix laricina*, *Hypericum kalmianum*, *Potentilla fruticosa*, *Carex polygama*, *Carex livida*, *Carex limosa*, *Carex filiformis*, *Eriophorum viride-carinatum*, *Cypripedium parviflorum pubescens*, *Sarracenia purpurea*, and *Utricularia cornuta*.

Around Mud Lake is an extensive bog, of which the substratum is made up of a comparatively thin layer of Sphagnum and intertwined roots over water or very thin mud, so that it can be shaken for many yards in all directions and is easily broken through. This bog is interesting chiefly because of the occurrence here of two rare members of the *Cyperaceae*—*Scirpus hudsonianus* and *Carex exilis* and because of the great abundance of *Cypripedium hirsutum*. This latter species is particularly abundant and luxuriant among *Thuja occidentalis* and *Larix laricina* along the eastern edge of the bog. At the end of June this section of the bog presents a glorious spectacle. The frontispiece to this number of the BULLETIN shows a clump of a dozen blossoms of this species and Fig. 2 shows two



Fig. 2—*CYPRIPEDIUM HIRSUM* IN BOG AT MUD LAKE.
ASPIDIUM THELYPTERIS IN FOREGROUND.

(Photo by KLUGH)

particularly tall specimens with *Aspidium thelypteris* in the foreground. In addition to the species already mentioned the flora of this locality was composed of :—*Potentilla fruticosa*, *Hypericum kalmianum*, *Myrica gale*, *Andromeda glaucophylla*, *Scirpus caespitosus*, *Eriophorum viride-*

carinatum, *Cypripedium parviflorum pubescens*, *Habenaria hyperborea*, *Habenaria dilatata*, *Smilacina stellata*, *Triglochin maritima*, *Carex limosa*, *Carex interior*, *Carex leptalea*, *Carex castanea* (at edge), *Carex flava* (at edge), *Tofieldia glutinosa*, *Cladium mariscoides*, *Parnassia caroliniana*, *Rhamnus alnifolia*, *Menyanthes trifoliata*, *Sarracenia purpurea* and *Leucobryum glaucum*. From a water-hole beneath an up-turned root in this bog I collected the following Algae *Chroococcus turgidus*, *Stigonema mamillosum* and *Spirogyra catenaeformis*.

LITHOPHYTIC FORMATIONS

These are formations developed upon rocks. But there are two very different formations of Lithophytes, viz :—Those existing upon exposed and dry rocks and those growing on moist shaded rocks or upon exposed rocks over which water trickles during the entire, or the greater part of, the summer. Since, as far as I am aware, there are no names for these two formations, I propose, and here use, the term Xeropetric formation for the plants of dry rocks and Pladopetric formation for those of moist rocks.

XEROPETRIC FORMATION

This formation is pretty extensively developed on the limestone cliffs on the eastern shore of the Peninsula, and on the gigantic rock-masses which have fallen from these cliffs. It consists mainly of the Lichens *Parmelia conspersa* and *Placodium elegans* and the Mosses *Orthotrichum anomalum* and *Grimmia apocarpa*.

PLADOPETRIC FORMATION

This formation is developed in many places along the base of the limestone cliffs. Where there is moisture but no shade it consists of the following Algae :—*Oscillatoria tenuis*, *Oscillatoria subtilissima* and *Calothrix parietina*. In the shade it consists of the Lichen *Baeomyces byssoides* and the mosses *Plagiothecium denticulatum* and *Bartramia oederi*. On a moist rock at Sky Lake the Hepatic, *Preissia quadrata* was common.

CHASMOPHYTIC FORMATION

Another formation is also found among plants growing among rocky places viz., the formation developed in crevices in the rocks. This is, in reality, a composite formation as these crevices may be moist or dry, and may contain much or little soil, consequently these

plants may be mesophytes or xerophytes. In crevices, in rocks, in the woods this formation takes its character from the surrounding mesophytes but there are two plants particularly characteristic of these shaded crevices and they are *Cryptogramma stelleri* and *Cystopteris bulbifera*.

PSAMMOPHYTIC FORMATION

Psammophytes are found only on the broad stretches of sand which form the shore of Lake Huron towards the base of the Peninsula, the most characteristic plants are *Juncus balticus littoralis*, *Scirpus pauciflorus*, *Scleria verticillata*, *Eleocharis acuminata*, *Carex oederi* and *Artemisia caudata*. Further inland along the Lake Huron shore are extensive sand hills but these are forested and only where the forest has been cut down and burnt over is the sand exposed. In such locations the exposed sand is soon acted upon by the wind and forms dunes. These dunes are of very recent origin and are constantly shifting so that they have no vegetation upon them.

CONIFEROUS FORMATION

The Bruce Peninsula unlike the country immediately to the south of it never was a pine country. There is in the deciduous forest formation a very free sprinkling of conifers, particularly *Picea canadensis* and *Abies balsamea* but also of *Pinus strobus* and *Tsuga canadensis*. There is one coniferous association pretty generally developed and that is the thick stand of *Thuja occidentalis* in the "Cedar Swamps." There are two other coniferous associations worthy of note because they are isolated areas of very limited extent differing widely from the surrounding formations. One of these is a mixed coniferous association at Oliphant on the western shore of what was until last year an island in Lake Huron but which is now a peninsula connected to the mainland by a stretch of sand because of the fall of the water in Lake Huron. Here the following conifers were present:—*Larix laricina*, *Picea canadensis*, *Abies balsamea*, *Thuja occidentalis*, *Pinus resinosa* (one tree), *Juniperus communis* and *Juniperus horizontalis*. Among and beneath these were *Dicranum undulatum*, *Pteris aquilina*, *Festuca occidentalis*—a western grass recorded in Eastern Canada only from the Bruce Peninsula (Klugh: Ottawa Naturalist, Oct., 1911), *Festuca ovina*, *Carex eburnea*, *Carex umbellata*, *Shepherdia canadensis*, *Lilium*

philadelphicum, *Anemone virginiana*, *Aquilegia canadensis*, *Arctostaphylos uva-ursi*, *Linnaea borealis*, *Lonicera dioica*. *Polygala senega*, *Rhus toxicodendron*, *Cornus canadensis*, *Commandra richardsiana* and *Senecio balsamitae*.

The other coniferous association is just south of Oliphant on the mainland. Here the dominant tree is *Pinus resinosa*, with occasional trees of *Picea canadensis* and *Thuja occidentalis*. Beneath and between these trees are:—*Juniperus communis*, *Juniperus horizontalis*, *Festuca ovina*, *Danthonia spicata*, *Scirpus caespitosus*, *Carex crawei*, *Carex scirpoidea*, *Carex aurea*, *Carex eburnea*, *Carex castanea*, *Iris lacustris*, *Smilacina stellata*, *Polygala senega*, *Houstonia ciliolata*, *Arenaria stricta*, *Campanula rotundifolia*, *Lobelia spicata*, *Satureja glabra*, *Arctostaphylos uva-ursi*, and *Artemisia caudata*.

MESOPHYTIC FORMATIONS

BUSHLAND FORMATION

This formation which usually goes by the name of Scrub or Thicket is extensively developed on the Peninsula. In many places, as along the shores of Georgian Bay and Lake Huron it is undoubtedly a primary formation, but in the interior it is a secondary formation arising on vast tracts originally covered with forest but which have been burnt over. A typical area of this Scrub on burnt over land had the following flora:—*Populus tremuloides*, *Populus balsamifera*, *Betula alba papyrifera*, *Salix humilis*, *Cornus stolonifera*, *Thuja occidentalis*, *Shepherdia canadensis*, *Pteris aquilina*, *Diervilla trifida*, *Apocynum androsaemifolium*, *Rubus idaeus aculeatissimus*, *Solidago canadensis*, *Aster macrophyllus*, *Aster cordifolius*, *Linnaea borealis*, *Fragaria virginiana*, *Cornus canadensis*, *Pedicularis canadensis*, *Carex aurea*, *Carex granularis*, *Poa pratensis*, *Oryzopsis asperifolia*, *Castilleja coccinea*, *Polytrichum juniperinum*, *Bryum caespitium*, *Ceratodon purpureus*, *Funaria hygrometrica*, *Cladonia rangiferina*, *Cladonia gracilis dilacerata*, *Cladonia fimbriata*, *Cladonia squamosa* and *Peltigera canina*.

The thickets along the Georgian Bay shore differ considerably in their flora from the foregoing, as may be seen from the following list of plants composing this formation at Cape Croker:—*Populus tremuloides*, *Populus balsamifera*, *Betula alba papyrifera*, *Quercus*

rubra (scarce), *Pinus strobus* (scarce), *Prunus virginiana*, *Salix humilis*, *Amelanchier canadensis*, *Cornus sericea*, *Physocarpus opulifolius*, *Shepherdia canadensis*, *Rosa acicularis*, *Rhus toxicodendron*, *Rhus typhina*, *Pteris aquilina*, *Fragaria virginiana*, *Arctostaphylos uva-ursi*, *Waldsteinia fragaroides* and *Prunus pumila*, which in open situations exhibits its usual prostrate habit, but in the shade is sub-erect. On the trees in this formation were the Lichens *Rinodina sophodes tephraeaspi* and *Physia stellaris*.

DECIDUOUS FOREST FORMATION

This formation as an *Acer-Fagus* association at one time covered the greater part of the Bruce Peninsula, and even now despite the inroads of lumbering and fire it is characteristic of large areas.

While *Acer saccharum* and *Fagus grandifolia* are the dominant trees of this formation, the following trees are interspersed in it and are given in the order of their frequency :—*Ulmus americana*, *Ostrya virginiana*, *Betula lutea*, *Betula alba papyrifera*, *Tilia americana*, *Picea canadensis*, *Abies balsamea*, *Tsuga canadensis*, *Quercus rubra*, *Pinus strobus* and *Juglans cinerea*.

These woods are all rocky woods and in the soil-filled crevices in these rocks many ferns grow.



Fig. 3—SECTION OF ACER-FAGUS FORMATION BETWEEN HOPE BAY AND BARROW BAY.

(Photo by KLUGH).

I have selected several sections of the floor of this formation in various parts of the Peninsula which together with the foregoing list of trees will give a good idea of the formation as a whole.

In woods between Hope Bay and Barrow Bay within the area shown in Fig. 3, on June 8th, were the following species :—*Peltigera canina*, *Mnium cuspidatum*, *Scolopendrium vulgare*, *Polystichum lonchitis*, *Aspidium spinulosum*, *Cystopteris bulbifera*, *Cystopteris fragilis*, *Adiantum pedatum*, *Botrychium virginianum*, *Festuca nutans*, *Melica smithii*—a western grass indigenous on the Peninsula and first recorded for Ontario by me in 1908, *Milium effusum*, *Carex deweyana*, *Carex laxiflora latifolia*, *Carex rosea radiata*, *Trillium grandiflorum*, *Allium tricoccum*, *Arisaema triphyllum*, *Hepatica acutiloba*, *Mitella diphylla*, *Tiarella cordifolia*, *Caulophyllum thalictroides*, *Dicentra canadensis*, *Hydrophyllum virginicum*, *Viola canadensis*, *Geranium robertianum*, *Osmorhiza longistylis*, *Ranunculus abortivus* and *Galium triflorum*.

The floor of moist woods at Colpoy's Bay had the following flora :—*Morchella bispora*—a Fungus recorded, as far as I know, only from the Bruce Peninsula (Klugh : Ontario Nat. Sc. Bulletin, No. 6, 1910), but here abundant and generally distributed in moist woods, *Morchella conica*, *Collybia radicata*, *Boletus scaber*, *Coprinus micaceus*, *Omphalia campanella*, on rotten stumps, *Pleurotus ostreatus*, on fallen logs, *Marchantia polymorpha*, *Peltigera canina*, *Mnium cuspidatum*, *Polystichum lonchitis*, *Aspidium spinulosum*, *Aspidium marginale*, *Cystopteris bulbifera*, *Cystopteris fragilis*, *Adiantum pedatum*, *Melica smithii*, *Asprella hystrix*, *Carex deweyana*, *Carex rosea radiata*, *Carex communis*, *Carex arctata*, *Carex laxiflora latifolia*, *Arisaema triphyllum*, *Trillium grandiflorum*, *Trillium erectum*, *Erythronium americanum*, *Smilacina racemosa*, *Polygonatum biflorum*, *Uvularia grandiflora*, *Maianthemum canadense*, *Allium tricoccum*, *Streptopus roseus*, *Habenaria bracteata*, *Corallorhiza striata* (rare), *Claytonia caroliniana*, *Ranunculus abortivus*, *Hepatica acutiloba*, *Hepatica triloba*, *Aquilegia canadensis*, *Actaea rubra*, *Actaea alba*, *Caulophyllum thalictroides*, *Sanguinaria canadensis*, *Dicentra cucullaria*, *Dicentra canadensis*, *Dentaria diphylla*, *Tiarella cordifolia*, *Mitella diphylla*, *Ribes cynosbati*, *Fragaria vesca americana*, *Rubus idaeus aculeatissimus*, *Geranium maculatum*, *Geranium robertianum*, *Polygala paucifolia*, *Celastrus scandens*, *Acer spicatum*, *Viola cucullata*, *Viola blanda*, *Viola*

pubescens, *Viola labradorica*, *Viola canadensis*, *Viola rostrata*, *Circaea alpina*, *Aralia nudicaulis*, *Osmorhiza claytoni*, *Osmorhiza longistylis*, *Cornus canadensis*, *Monotropa hypopitys*, *Galium triflorum*, *Mitchella repens*, *Lonicera canadensis*, *Viburnum acerifolium*, *Sambucus racemosa*, *Solidago latifolia*, *Solidago caesia axillaris*, *Aster macrophyllus* and *Aster cordifolius*.

On the tree trunks in this formation the following Fungi and Lichens grow :—*Polyporus applanatus*, *Polyporus hirsutus*, *Polyporus lucidus*, *Sticta pulmonaria*, *Sticta amplissima*, *Parmelia caperata*, *Ramalina calicaris*, *Physia stellaris*, *Rinodina sophodes tephrae*.

In a rocky wood, on a steep slope near Cape Croker is one of the very few stations in Canada for *Aspidium filix-mas*. Fig. 4 shows this fern growing in a soil-filled crevice in the rock accompanied by *Cystopteris bulbifera*, *Tiarella cordifolia* and *Geranium robertianum*.



Fig. 4—*ASPIDIUM FILIX-MAS* IN ROCKY WOODS
NEAR CAPE CROKER.

(Photo by KLUGH).

There are of course many plants on the Bruce Peninsula which are not mentioned in the preceding lists because they do not happen to have been present in the sections of the formations which were under consideration.

Ginseng and its Diseases.

PROF. WHETZEL, CORNELL UNIVERSITY, ITHACA, N. Y.

GINSENG is a wild plant which has recently been brought under cultivation. It grows wild on the woody hillsides of ravines in the forests of northern United States and Canada, and in the mountain regions of the warmer parts of North America. But it is fast disappearing as a wild plant for the ginseng hunters seek it far and wide. Formerly it was only the larger roots that were sought to be dried and sold. Now everything from seed and seeding to roots is carefully gathered and transplanted into the ginseng beds of the cultivator. Ginseng in this country has been under cultivation only during the past 15 or 20 years. In Japan and Korea it has been under cultivation for 200 years or more. One of the most striking features of ginseng cultivation as it has developed in this country is the remarkable development of diseases. In the early days, the pioneers appear to have experienced little loss in their plants, but from about 1902 to the present day the diseases have often times become the controlling factor in the success of the business. The question is commonly asked from whence have come these diseases and why have they become so destructive. At least fifteen more or less destructive diseases of ginseng are now known. These are only the ones caused by fungi or bacteria. The insect pests of the ginseng are as yet very few and are not very serious.

It is not our intention here to discuss the diseases but merely to point out, if we can, some fundamental facts which from six years of study, we have come to regard as the chief factors in bringing about the disease situation in the ginseng gardens. The diseases of ginseng are of two different types; those attacking the parts above the ground and those attacking the roots. In but a few cases does the same disease effect both parts of the plant. The most destructive disease attacking the ginseng above the ground is the *Alternaria* Blight, a fungus disease which attacks stems, leaves and fruit, and when once established in a garden may completely kill all of the tops within a few days. Another disease which acts in somewhat the same fashion is the Mildew. It has not come to be so very destructive in this country as yet, though several gardens have suffered from it. It is the chief



FIG. 1—ALTERNARIA BLIGHT EPIDEMIC.

disease in Japan. The principal diseases of the roots are the Fiber Rot or Rust which rots the fibers of the young plants and covers the root with a rusty scab; the Wilt, caused by a fungus which enters the root through the old stem scars, infests the sap tubes of the root and



Fig. 2—ALTERNARIA BLIGHT SPOTS ON LEAVES, KNOWN
USUALLY BY THE RUSTY BROWN BORDER.



FIG. 3—BLACK ROT MUMMY.

interfering with the water supply, causes the tops to wilt; the Soft Rot, probably a bacterial disease, very destructive in poorly drained soil, causing the roots to become soft and mushy; the Black Rot which attacks the roots only during the winter, killing them and leaving them as tough, black mummies in the soil; and the White Rot, a fungus disease which attacks the roots, particularly at the crown, producing a very soft and mealy white rot. This fungus may also attack the stem. The affected portions of the stem rot throw out white tufts of mycelium which soon develop into very black Sclerotia. Then there are certain damping off diseases of seedlings which are often very destructive. These diseases have been more fully described in various articles in "Special Crops" a ginseng growers paper published at Skaneateles, N. Y., and in Bulletin 219 of the College of Agriculture, Ithaca, N. Y. A new bulletin giving more detail is soon to be issued from the Bureau of Plant Industry, Washington, D. C.

Having indicated briefly the chief diseases of the ginseng, we may now consider those fundamental factors which have favored the development of these maladies. In the first place ginseng, like other wild plants, is naturally subject to fungus diseases, but the wild plants being separated by hill and dale, with thick stands of forest trees and thickets between them, there was little opportunity for the spread of fungus diseases from one patch to another. They were confined to a

few plants in more or less limited areas, and epidemics such as are to be seen in cultivated plants in gardens could seldom occur. When these plants were brought into the garden and crowded together in large areas, the parasites causing the diseases were brought with them. Here they found conditions ideal for their development. The plants touched each other. Some of the spores developed on one plant were almost sure to find moisture and lodging conditions favorable on many of the other plants. A light breeze blowing through the garden scattered them throughout the crowded plants. The fact of the crowded condition under which ginseng must be cultivated is therefore one of the chief factors favoring such diseases as *Alternaria* Blight and the Mildew.

The ginseng hunter, when he began to consider ginseng cultivation as a means of increasing his income, took note of the fact that the ginseng plant required shade. This he provided at once, at first by the crude frame of brush covers and later developed the modern types of lath shading now generally used. He thus provided one of the important requisites of nature, shade, but he entirely overlooked two other very important factors, which failing to consider, has brought him no end of trouble in the way of disease. Seldom did he consider the necessity of providing artificial drainage for his gardens. The slope of the land or the character of the soil were considered sufficient to remove the excess water. He failed to consider that the steep hill-sides where the ginseng naturally grows were covered with forest trees whose roots pumped up water to be evaporated from the leaves above and thus kept the soil free from excess water. The result has been heavy loss in the wet seasons, especially in heavy low land soils, from the soft rot. Repeated experiments with the tile drainage in lands where the Soft Rot flourished have brought about almost entire freedom from the disease. It is only in recent years that the ginseng grower has found out that there is very little soil that does not require tile drainage. The root diseases here indicated have been the price paid for failure to provide proper drainage.

The development of Fiber Rot or Rust which has become so destructive in the past few years appears to be due very largely to the failure on the part of the growers to consider the character of the soil in which the ginseng naturally grows. This Fiber Rot or Rust is

caused by a fungus which is especially favored by an alkaline condition of the soil. The leaves of broad leafed trees are known to be high in acid when they fall in the autumn. This acid is quickly leached out during the autumn rains and thereby causes an acid condition of the soil. The fungus which causes this disease is very general in garden soils in which the ginseng was in the early days of cultivation often



Fig. 4—RUST OR END ROT OF SEEDLINGS.

planted. Such soils are often high in acid and therefore the pioneer growers experienced very little disease, but in recent years ginseng growers began the use of wood ashes and lime to a very considerable extent. Soils which were naturally more or less acid soon became alkaline. Whether this was favorable to the ginseng is a question.

Certain it is that it was favorable to the root rot fungus and it began to flourish. So general was the use of lime and ashes that there is scarcely a ginseng grower whose garden has escaped the ravages of this disease. The result is that the ginseng grower by leaf mulches in the autumn and the application of acids and acid phosphates is trying to bring the soil back to an acid condition like that of the forest soil in which the ginseng naturally grows.

The four factors, crowding, shade, drainage and soil acidity have been it seems, from our study and observations, the most important in determining the development of disease epidemics in the ginseng garden. The study of the development of these diseases in ginseng is interesting from a more general point of view than that of the ginseng grower alone. It shows us how the diseases of other cultivated crops, whose history is lost in antiquity, must have developed and should serve as a lesson in bringing under cultivation other types of wild plants.

The Rosaceae and Leguminosae of Galt, Ont. and Vicinity.

BY W. HERRIOT, GALT, ONT.

THE following 88 species of the Rose and Pea Families were collected by the writer within a radius of ten miles from Galt.

Of the 52 species of Rosaceae 45 are indigenous and 7 are introduced from Europe.

Of the 36 species of Leguminosae 12 have become naturalized or been introduced from Europe while 3 are native to the United States.

ROSACEAE

1. *Physocarpus opulifolius* (L.) Maxim. Nine-bark.—Rocky banks along streams. Infrequent.
2. *Spiraea salicifolia*, L. Meadow-sweet.—Low meadows and peat bogs. Common.
3. *Pyrus coronaria*, L. American Crab-apple.—Thickets and hillsides. Frequent.
4. *Pyrus Malus*, L. Apple.—Roadsides and woods. Escaped from cultivation. Frequent.

5. *Pyrus melanocarpa* (Michx) Willd. Black Chokeberry.—Moist woods and swamps. Frequent.

6. *Pyrus Aucuparia* (L.) Ehrh. European Mountain Ash.—Naturalized in woods and rocky places. Frequent.

7. *Amelanchier canadensis* (L.) Medic. Juneberry.—Woods, clearings and along fences. Common.

8. *Amelanchier oblongifolia* (T. & G.) Roem. Juneberry.—Woods and open places. Very variable in form of leaf. Common.

9. *Amelanchier spicata* (Lam.) C. Koch. Dwarf Juneberry.—Open woods and along fences. Frequent.

10. *Crataegus crus galli*, L. Cockspur Thorn.—Thickets and clearings. Common.

11. *Crataegus punctata*, Jacq. Large Fruited Thorn.—Open woods and fields. Common.

12. *Crataegus coccinea*, L. Scarlet Thorn.—Thickets, fields and hillsides. Common.

13. *Crataegus tomentosa*, L. Pear Han.—Open woods and fields. Rare.

14. *Crataegus oxyacantha*, L. English Hawthorn.—Escaped from cultivation in a few places along the Grand River.

Since the above five species of *Crataegus* were collected about twenty years ago nothing has been done by the writer to unravel the many intricate forms that of late years have been separated as species.

Southwestern Ontario offers one of the richest regions in the world for *Crataegus*. In Bulletin No. 4, Wellington Field Naturalists' Club, 1908, Dr. C. S. Sargent lists 95 species found in Ontario.

15. *Fragaria virginiana* Duchesne. Wild Strawberry.—Woods, clearings and fields. Common.

16. *Fragaria vesca*, var, Americana. Porter. Wood Strawberry.—Rich and rocky woods. Common.

17. *Waldsteinia fragaroides* (Michx), Trattinick. Barren Strawberry.—Dry and rich woods. Common.

18. *Potentilla arguta pursh*. Clammy Cinquefoil.—Dry exposed places. Common.

19. *Potentilla monspeliensis*, L. Rough Cinquefoil.—Dry or moist places, especially in fields. Common.
20. *Potentilla argentea*, L. Silvery Cinquefoil.—Dry, grassy fields and banks. Common.
21. *Potentilla recta*, L. Rough-fruited Cinquefoil.—Fields and roadsides. Common.
22. *Potentilla palustris*, (L.) Scop, Marsh Cinquefoil.—Marshes and peat bogs. Common.
23. *Potentilla fruticosa*, L. Shrubby Cinquefoil.—Swamps and marshes, chiefly around ponds. Common.
24. *Potentilla anserina*, L. Silver-weed.—River shores and gravelly margins of ponds. Common.
25. *Potentilla canadensis*, L. Five-finger.—Dry banks, thickets and fields. Common.
26. *Geum canadense*, Jacq. White Avens.—Rich and moist woods, and copses. Common.
27. *Geum virginianum*, L. Along the Grand river in a few places. Rare.
28. *Geum strictum* Ait. Yellow Avens.—Swamps and low grounds. Common.
29. *Geum rivale*, L. Purple Avens.—Wet woods and swamps. Common.
30. *Geum triflorum*. Pursh. Three-flowered Avens.—Dry, open woods and fields. Rare.
31. *Rubus occidentalis*, L. Black Raspberry.—Open woods, clearings and along fences. Common.
32. *Rubus odoratus*, L. Purple Flowering Raspberry.—Open woods. Rare.
33. *Rubus triflorus*. Richards. Dwarf Raspberry.—Wet woods and cedar swamps. Common.
34. *Rubus idaeus* var *aculcatissimus* (C. A. Mey.) Regel and Tiling. Red Raspberry.—Woods, clearings and along fences. Common.
35. *Rubus allegheniensis*, Porter. High Blackberry.—In dry or moist thickets and along fences. Common.

36. *Rubus nigricans* Rydb. Bristly Blackberry.—Moist thickets chiefly bordering ponds. Infrequent.
37. *Rubus villosus* Ait. Dewberry.—Dry, Open woods and fields. Rare.
38. *Dalibarda repens*, L. Dalibarda.—Cedar swamps. Confined though plentiful to a chain of swamps extending from the vicinity of Blair, along Cedar Creek, about 6 miles west of Galt to Ayr, Ont.
39. *Agrimonia gryposepala*, Wallr. Hairy Agrimony.—Woods and thickets. Frequent.
40. *Agrimonia mollis*, (T. & G.) Britton. Soft Agrimony.—Dry woods. Rare.
41. *Rosa blanda* Ait. Early Wild Rose.—Dry banks and exposed places. Common.
42. *Rosa rubiginosa*, L. Sweetbrier.—Roadsides and along fences. Occasional in woods.—Frequent.
43. *Rosa carolina*, L. Swamp Rose.—Swamps and around ponds. Frequent.
44. *Rosa virginiana*, Mill. Shining Dwarf Rose.—Open woods and clearings. Common.
45. *Rosa humilis*, Marsh. Dwarf Rose.—Open woods and clearings. Frequent.
46. *Prunus serotina*, Ehrh. Wild Black Cherry.—Woods and fields. Common.
47. *Prunus virginiana*, L. Choke Cherry.—Woods, clearings and along fences. Common.
48. *Prunus pennsylvanica*, L. f. Pin Cherry.—Open woods and clearings. Frequent.
49. *Prunus mahaleb*, L. Perfumed Cherry.—Roadsides and low woods. Escaped from cultivation in few places.
50. *Prunus instititia*, L. Blackthorn.—One large colony growing in a field recently cleared of timber. Apparently established for many years, likely through the agency of birds.
51. *Prunus nigra* Ait. Canada Plum.—Thickets and along streams. Frequent.
52. *Prunus americana*, Marsh. Wild Plum.—Dry or moist thickets and along fences. Common.

LEGUMINOSAE

1. *Gleditsia triacanthos*, L. Honey Locust.—Cultivated ground and road sides. A handsome tree naturalized in a few places.

2. *Lupinus perennis*, L. Wild Lupine.—Open, sandy woods and banks. Infrequent.

3. *Trifolium pratense*, L. Red Clover.—Fields and roadsides everywhere. Common.

4. *Trifolium repens*, L. White Clover. Fields, roadsides and open woods. Common.

5. *Trifolium hybridum*, L. Alsike Clover.—Fields and roadsides. Common.

6. *Trifolium agrarium*, L. Hop Clover.—Dry fields and roadsides. Infrequent.

7. *Trifolium procumbens*, L. Smaller Hop Clover.—Fields and waste places. Rare.

8. *Trifolium dubium*, Sibth. Least Hop Clover.—Plentiful in Dickson park.

9. *Melilotus officinalis* (L.) Lam. Yellow Sweet Clover.—Roadsides and waste places. Common.

10. *Melilotus alba*, Desr. White Sweet Clover.—Roadsides and waste places. More plentiful than the preceding.

11. *Medicago sativa*, L. Alfalfa.—Cultivated and becoming established in old fields and by roadsides.

12. *Medicago lupulina*, L. Black Medick.—In fields, lawns, and waste places. Common.

13. *Medicago hispida* Gaertn. Bur Clover.—Waste places around a woolen mill.

14. *Robinia Pseudo-Acacia*, L. Common Locust.—Cultivated and established along roadsides and about old dwellings. Frequent.

15. *Robinia viscosa*, Vent. Clammy Locust.—Around old dwellings and escaped from cultivation to roadsides. Infrequent.

16. *Astragalus canadensis*, L. Milk Vetch.—Woods and open places. Infrequent.

17. *Astragalus neglectus* (T. & G.) Sheldon. Milk Vetch.—Along the Grand River. Rare.

18. *Glycyrrhiza lepidota* (Nutt.) Pursh. Wild Liquorice.—On an island in the Grand River below Galt. A rare plant in Ontario, but plentiful on the western prairies.

19. *Desmodium nudiflorum* (L.) D. C. Naked-flowered Tick-Trefoil.—In dry woods. Frequent.

20. *Desmodium grandeflorum* (Walt.) D. C. Large-flowered Tick-Trefoil.—In dry woods. Common.

21. *Desmodium bracteosum* (Michx.), D. C. Large bracted Tick-Trefoil.—Dry, open woods. Rare.

22. *Desmodium Dillenii*, Darl. Dillen's Tick-Trefoil.—Dry woods. Infrequent.

23. *Desmodium paniculatum* (L.), D. C. Panicked Tick-Trefoil.—Dry woods and copses. Common.

24. *Desmodium canadense* (L.), D. C. Canada Tick-Trefoil.—Open woods and fields. Infrequent.

25. *Desmodium marilandicum* (L.), D. C. Small Tick-Trefoil.—Dry woods. Rare.

26. *Lespedeza frutescens* (L.), Britton. Purple Bush Clover.—Dry open woods. Frequent.

27. *Lespedeza hirta* (L.) Hornem. Hairy Bush Clover.—Dry woods and open places. Infrequent.

28. *Lespedeza capitata*, (Michx.) Common Bush Clover.—Open woods and fields, in dry places. Common.

29. *Vicia sativa*, L. Spring Vetch.—Fields and waste places. Frequent.

30. *Vicia cracea*, L. Tufted Vetch.—Borders of woods and in fields. Infrequent.

31. *Vicia caroliniana*, Walt. Carolina Vetch.—Open woods and clearings. Common.

32. *Vicia americana*, Muhl. American Vetch.—Dry or moist woods. Frequent.

33. *Lathyrus venosus*, Muhl. Veiny Pea.—Open woods and banks. Rare.

34. *Lathyrus ochroleucus*, Hook. Cream Colored Vetchling.—Open woods and clearings. Frequent.

35. *Apios tuberosa*, Moench. Groundnut.—Damp thickets. Infrequent.

36. *Amphicarpa monoica* (L.) Ell. Hog Peanut.—Rich and moist woods. Common.

Galt, Dec. 26th, 1911.

Jungle Life on the Hills of South India.

BY G. J. SPENCER.

THE hills of Southern India present a pleasing harmony between the luxury of the Tropics and the milder and less vivid coloring of the temperate regions. The foot of the hills is essentially tropical; dense forests cover the slopes, divided up into regular sections by the fire paths of an active forest department. The trees are all hardwood, and among the "jungle trees" the teak and sal represent valuable timber. Here and there matted bamboo clumps afford retreat to small animals and birds, for a large animal cannot hurry through them and one can generally find the jungle fowl and partridge or quail scratching vigorously among the dried leaves, safe from the swooping hawk or the pouncing jackal who has very little to hide him among the bamboo stems.

It is in these foot-hill forests that the tigers and panthers find good hunting among the sambhur and spotted deer, and only in the dry season when the land is parched, do they go further up the hills after the deer which move upwards for green grass and the mountain streamlets. In the dense forests also live the peacock and sometimes one comes across a native mud temple, hidden away among the huge trees, where the priests regard the peacock as sacred and feed him, and are ever ready to fight fiercely with their bamboo staves if a foolish sportsman should shoot one of the temple birds. The peacocks' love dance is in the form of a figure 8 and the pea-hens look on admiringly at their lords' extended tails. It is curious that these forests are very silent although they teem with animal, bird and insect life. Only at night can one hear the animals when the forest utters strange noises, but the birds in their bright plumage generally fly silently, except in the early morning and afternoon, and then they sing for a short time. The only bird that loves his own voice is the big

green barbet (Family *Capitonidae*, gen. *Cyanops* and *Chotorhea*), and his thot-r-r-r-thotrrr-thotrrr can be heard for miles. During the heat of the day everything rests and even the only noisy animal in the jungle, the Rhesus monkey who swings from tree to tree and chatters as he goes, seems to recognise the siesta hour, and is silent.

At night the jungle awakens and speaks with myriad tongues. A belated wren hunting for insects among the fallen leaves after the sun has gone down, makes a noise like a vigorously scratching hen; a jackal causes one's blood to creep by his sudden piercing call of "Hindoo ooo, where's the Hindoooo," and the pack echoes "Where, where, where?" as they trot over the hills hunting for what they can find. They are not always particular as to their food, as the scratched-up shallow graves of the hill men and the gleaming skulls in the grass of some little clearing among the trees can testify hence the call of the jackals. The wild black pig leaves his lair to grub noisily among swamps for spear grass roots and wild potato tubers, disgusting all the respectable forest animals, who feed silently. At certain seasons of the year he leaves the jungle with a numerous family, and attends to the gardens of Man, just when the Easter Lilies are about to flower. He works well, even venturing on to verandahs in search of the lily bulbs and has seldom been known to leave a single bulb, except when the lily was potted.

Sometimes the noisome hyena lifts his ghastly demoniacal voice but he is not often met with and does not cause much damage. But panthers take a yearly toll from the native herdsmen, and a dog or two and occasionally a washerman's straying donkey does not come amiss to them. The panther is the only animal that monkeys fear, and fear badly, for he climbs trees like a cat. The rock snake can also climb and he likes a toothsome monkey now and then, but the panther is their worst enemy. The most plaintive sounds one can ever hear in a jungle are those uttered by the monkeys when a panther surprises them asleep in the trees. Once heard it can never be forgotten for it is almost human in its wailing terror.

When night has just fallen one can sometimes hear the sambhur bell and the spotted deer bark as they leave the deep glens for the grassy hillsides. The night jar calls from some thick clump of trees as he feeds on the innumerable insects that come out at night, and from the top of the tallest, thickest trees, comes the deep "boom,

boom" of the enormous booming owl. This is the time when the jungle speaks—this is the real time to know it, to fear it and to love it. The tiger cat, a superb creature as big as a very large tom cat and striped exactly like a tiger, leaves his little rocky den to hunt for hare or fat white-bellied field rats; the "tree dog" or civat cat sneaks his four feet of evil smelling length out of a hole in some tree, and dines off fruit, birds and small rodents, or, if he cannot find stray hens or a bunch of ripening bananas around some planter's house, he eats ripe coffee from the nearest estate, where he may perhaps find the jackal similarly engaged, for the latter also eats much coffee; a little sucking pig may perhaps provide the rock python's three-weekly or monthly dinner, and some of the smaller of his brethern, the grass snakes, may fall victims to the keen scented and active mongoose. There is no peace in the jungle, every animal is preyed upon by some other animal, and even the lordly panther, with powerful muscles rippling under his beautiful spots, may at any time of the hot weather be attracted to the tied-up goat bleating with the pain of a stone sewed into its ear lobe, and fall foul of man, the worst enemy that ever disturbed the jungles.

Further up the hills, where it is cooler, are found slightly different conditions and some other animals. The porcupines' quills may be found along animal paths, which are so clear to those who know and look for them, and invisible to those who do not understand the ways of the wild things. The little clearings here and there in the jungle tell their own story: of the delicate little mouse-deer who leaves a spoor no bigger than a man's thumb nail and who can travel as fast as a galloping horse; of the slightly longer and broader tracts of the little hog deer, that rare freak of Nature which has a deer's body, skin and spots and the shoulders and short feet of a pig; of the buck hare whose droppings are so similar and yet so different from those of his doe; of the large, hurried scratching of the jungle cock, who is always afraid that his brilliant plumage will attract attention, and the smaller, deeper scratches of the spur fowl whose sombre colors give him greater safety; of the little slanting hole that the field rat dug to reach some juicy grass root; of the little bulbul's broken egg, which the crow robbed and carried as he generally does to the little clearing before eating it; of the distinct narrow trail of the big black soldier ant, as he moved in column to better feeding grounds in some termites

nest, and lastly of the hill man's spreading toe-mark, as he read all these signs.

The vast coffee estates planted on steep rocky hillsides and sheltered from the sun by special shade trees, provide cover for many birds and animals. Wild blue pigeons feed among the trees and nest in niches on the face of some high precipice ; the beautiful bronzed-winged dove humbly searches for weed seeds under the trees and sometimes visits the barnyards of planters to pick up grain thrown to the hens ; the tiresome ring dove coos incessantly and monotonously in the "dariah" (shade) trees and the barbet gulps down big, sweet coffee berries, or fights fiercely for the possession of a half completed nesting hole in a dead tree, whilst the finest songster of the hills, the seven-colored thrush, fills the air with his music as his mate sits on the nest.

These plantations are really the homes of the singing birds for their dense dark foilage affords excellent nesting places, and the trees, which are set in six or 8 feet squares, nearly touch one another and provide good shelter for feeding grounds. It seems as if the presence of man cheers the birds and attracts the songsters for their music can always be heard around the house and compound of one who respects and loves them, and but rarely in the dense jungles, which would seem to be their real homes. But the rare and, if anything, the more beautiful birds, as the minivet, paradise fly-catcher, crow-pheasant or copper crow, and the king bird of paradise can only be found in silent deep woods or the more remote valleys.

Liliaceae of County Peel.

BY J. WHITE, SNELGROVE, ONT.

Allium tricoceum, Ait. Common.

Asparagus officinalis, (L.)—Roadsides. Common.

Clintonia borealis. (Ait.) Raf.—Swamps. Common.

Erythronium albidum, Nutt. Found only in one locality along the flats of the Credit River, near Churchville.

Erythronium americanum, Ker.—Open woods. Common.

Lilium canadense. L.—Low flats. Common.

- Lilium Philadelphicum*. L.—Open woods. Rare.
Maianthemum canadense, Desf.—Open woods. Common.
Medeola virginiana. L.—Becoming rare in woods.
Muscari botryoides. (L.)—Mill. An occasional escape from gardens.
Polygonatum biflorum. (Walt.) Ell.—Woods. Common.
Smilacina racenosa. (L.) Desf.—Woods. Common.
Smilacina stellata. (L.) Desf.—Low flats. Frequent.
Smilacina trifolia. (L.) Desf.—Bogs. Common.
Smilax herbacea, L.—Open thickets. Common.
Smilax hispida, Muhl.—Open woods. Frequent.
Streptopus roseus, Michx.—Open woods. Common.
Trillium erectum, L.—Open woods. Common. The form with greenish-yellow petals is a rare occurrence in swamps here.
Trillium grandiflorum. (Michx.) Salisb.—Woods. Common.
Uvularia grandiflora. Sm.—Frequent in woods.

The Bartramian Sandpiper Breeds Near Guelph.

BY HERBERT GROH.

EARLY in May of the present year, 1911, the attention of myself and friends was arrested by the weird cries of this bird, coming from somewhere in the neighboring fields. Its long-drawn, doleful "kr-r-r-lo-o-o" was so different from any of the accustomed sounds of the countryside, that for a time there was much speculation as to its probable source. It was not until a pair of strange birds was sighted in a pasture field close to the house, that a clue was afforded. The birds were wary, and no immediate opportunity was given for identification, but our hopes for further acquaintance with them were happily gratified by subsequent events, as the pair remained long enough to hatch and rear a brood of young.

By a lucky chance the nest was discovered on the very day, June 13th, when the eggs began to hatch out. It was a simple affair of grass lining a depression in the ground. Although it was only thirty feet away from a regularly used driveway, and a herd of cows crossed

the ground every day, still no suspicion had fastened upon the site during the whole of the period of incubation. Once the secret was out, however, the birds resorted to the well-known methods of deception practised by other sandpipers and plovers. While one kept at some little distance, the other was industriously feigning injury, and both finally took to beating about the air overhead.

Two young birds were hatched when the nest was found, and were joined by another within another day, while the fourth egg proved to be worthless. The young left the nest by the second day, and four days later the whole party was frequenting the opposite side of the seventeen-acre field. But for the movements of the parent birds their whereabouts certainly would have been lost. Little was ever seen of the young after they left the nest, but, when nearly two weeks old, they were fairly well feathered, and were quite active in getting about over the ground. The old birds still manifested much concern over any intrusion, and were constantly uttering an alarm cry which, for want of a better description, might be said to bear some resemblance to the voice of the tree frog. Their short, nervous flights, were interesting to watch because of the dainty way in which, on alighting, they always stretched their wings aloft before deliberately folding them again.

The little family was frequently seen and heard in various fields in the neighborhood during the weeks following, but, by about the middle of July, they had left, or possibly wandered beyond hearing range. The Bartramian Sandpiper is known to begin its southward migration very early; but if these individuals left at this date, they were even earlier in their departure than accounts state. However, their arrival was also about two weeks earlier than the dates commonly reported for Ontario. It would appear as though this species comes north solely to breed, and stays only long enough for the brood to prepare for the long journey to the south.

This record of the occurrence and breeding of the Bartramian Sandpiper near Preston appears to be the first for the district surrounding Guelph. It fails by only a little of being in Wellington County, being west of Puslinch Lake nearly three miles, and distant from Guelph about eleven miles. Regarding the distribution of this bird, Mr. C. W. Nash writes: "In Ontario it only occurs in a few localities, and in small numbers. I have found it breeding in the counties of

Brant and Norfolk, and on Amherst Island, and Dr. Clarke reports it as breeding regularly near Kingston. In Manitoba, where it is generally known as the Upland Plover, it is sufficiently abundant to be of interest to sportsmen."

Preston, Ont.

April 30th, 1912.—Evidently these birds mean to repeat their breeding in this locality, as they have been heard again this spring on April 25th and following days by the writer, and some days earlier by others, who were familiar with the characteristic cry last year. These dates for spring arrival correspond very well with those given for various localities in Cooke's "North American Shorebirds," Biol. Survey, Bulletin No. 35, U.S. Dept. of Agriculture.

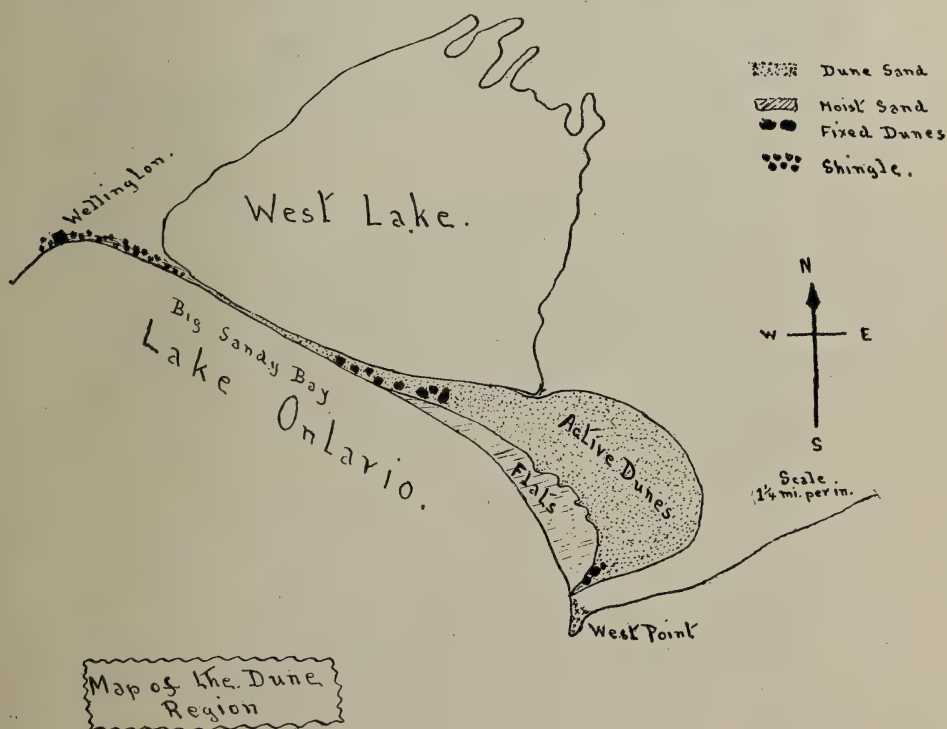
The Flora of the Sand Dunes of Prince Edward County

By A. B. KLUGH, M.A.

THE sand dunes of Prince Edward County, Ontario, are situated just east of Wellington, on the Lake Ontario shore. Before dealing with the flora, it will be well first to consider the manner in which the habitats in which that flora now grows came into existence. It will be seen from the map that a barrier beach extends from near Wellington to the dunes proper, cutting off West Lake from Lake Ontario. West Lake was at one time undoubtedly a bay, and the barrier beach has been thrown up by wave-action. For the formation of dunes, two factors are essential—sand and a prevailing wind. In the case of dune-formation near bodies of water, the shore must be a gently sloping one. The waves carry the sand up on to the beach; here it dries as soon as the storm which deposited it has subsided. The next heavy wind carries the sand inland before the waves have become sufficiently high to roll in upon it. The sand is carried inland until the force of the wind is broken by some obstacle, when the load of sand, or part of it, is deposited. If the obstacle is an inanimate one, it is soon buried. If it is a psammophytic plant (as is most likely to be the case), the plant grows, keeping pace with the growth of the sand. Thus is formed an embryo dune. As the dune rises higher and higher, it becomes more and more exposed to the force of the wind, until a point is reached where the vegetation is no longer able to hold the

dune. Then the sand is carried from the top of the dune, and rolls down the landward side. This action gives rise to a dune with a gentle slope of about 5 degrees on the windward, and a slope of about 30 degrees (the greatest angle at which dune sand can stand) on the lee side. The dune is now an active or wandering dune, and travels inland by the constant rolling of sand up the windward slope and down the lee slope.

As long as the progress of the active dune is at all rapid, no vegetation can gain a permanent foothold upon it; but if for some reason the progress is slow, plants creep up the lee slope, and *Ammophila*



arenaria will cover the crest and the windward slope. Then psamphytic willows, such as *Salix syrticola* and *Salix glaucophylla* come in, and finally a forest of such trees as *Populus deltoides*, *Thuja occidentalis* and *Tilia americana* covers the dunes. The dunes are now termed

fixed dunes, and this was the condition of the dunes near Wellington about a hundred years ago. That there was a range of fixed dunes near the shore at some time is apparent to the botanist, from the remains of these dunes still existing; and I learned from Mr. Wm. Hyatt, whose grandfather was one of the first settlers in the locality, that the dune range was practically continuous near the lake about a hundred years ago.

About seventy-five years ago the cedars on the dunes had been cut down to such an extent that the wind was once more able to act on the sand, and "wind-sweeps" were formed through the fixed dunes (Fig. 1). Now, once a "wind-sweep" is formed, the destruction of



Fig. 1.—"WIND-SWEEP" BETWEEN REMAINS OF FIXED DUNES.

a fixed dune is rapid, for as the sides of the trough become steeper, the trees are undermined, and fall into the trough. Thus the fixed dunes become rejuvenated dunes. A picture painted about fifty years ago, and now in the possession of Mr. Whattam, of the Lake Shore House, shows the dune cut into a succession of peaks, with deep "wind-sweeps" between.

Since that time most of the peaks have been completely eroded, only a few remaining in the positions indicated on the map, and the dunes have advanced inland so as to leave a large flat between the shore and the active dunes. This flat is covered with water in the spring, and is moist at all times (Fig. 2).



Fig. 2.—GENERAL VIEW OF DUNES NEAR THE LAKE.
MOIST SANDS FLAT IN MID-DISTANCE.

To the east the dunes have advanced upon a forest of *Thuja occidentalis* and *Picea canadensis*, and the dead tops of the tallest of these trees may now be seen protruding from a dune about sixty feet in height (Fig. 3). Two farms in clearings in this forest have been en-



Fig. 3.—VIEW ON TOP OF DUNE, ABOUT SIXTY FEET IN HEIGHT.
TOPS OF BURIED CEDARS PROJECTING.

croached upon to such an extent that the orchards are now being buried. The road which runs from West Point to Bloomfield has had



Fig. 4.—TREES BURIED BY ADVANCING DUNE.

to be moved five times in the past forty years, and it is now once again being covered with sand.

Further to the north the Evergreen House, once a popular summer resort, has had part of its out-buildings buried, and the pump within



Fig. 5.—DUNES ADVANCING INTO WEST LAKE.

a few yards of the back door is now at the base of the lee slope of a dune some sixty feet in height. To the north-west the dunes have advanced upon a farm to such an extent that of the original fifty acres but about ten are now left uncovered by sand. A large tree of *Ulmus americana* which once stood in a pasture, now has only its top projecting from the top of the dune, and a patch of *Populus tremuloides*, *Fraxinus americana* and *Betula alba papyrifera* has been buried, so that only the dead tips of the topmost branches are visible (Fig. 4).

Further to the north-west the dunes are advancing into West Lake (Fig. 5).



Fig. 6.—ON TOP OF THE DUNES.

REMAINS OF BURIED FOREST, ONCE BURIED MORE DEEPLY, NOW RESURRECTED, AS SAND HAS PARTLY PASSED ON.

Local testimony places the advance of the dunes at about forty feet per year, and claims that the greatest advance takes place in winter, when a mixture of snow and sand is carried along by the strong south-west winds.

Having thus sketched the topography of the locality at the present time, we shall now consider the erological factors which act upon dune plants.

First there is the nature of the soil. This is a fine-grained quartz sand, the grains averaging one-fifth of a millimeter in diameter. Most

of the grains are clear quartz, thus giving the dunes their white appearance, though some of them are colored yellowish-brown by ferric oxide. Occasional black grains are apparently hornblende. Sandy soil lacks cohesion, hence the ease with which the particles are moved by the wind. It is also very porous, and thus oxidation is rapid, and the formation of humus from plant remains is checked.

Secondly, the dune sand is dry, because the lack of cohesion and porous nature of sand favours rapid evaporation from the surface



Fig. 7.—PORTION OF WINDWARD SLOPE. REMAINS OF FIXED DUNES AT LEFT. *AMMOPHILA ARENARIA* IN FOREGROUND.

layers, rain sinks in very rapidly to the water level, and capillarity is not so strong in sand as in finer soils.

Thirdly, owing to the low specific heat of sand, the temperature changes are great and sudden. Exposed as they are to the full power of the sun, the dunes become excessively hot at mid-day in summer. Fourthly, the light is intense, as the white sand reflects the sun's rays. Fifthly, the plants on dunes are exposed to the full sweep of strong winds. The wind exerts a three-fold action: it tends to dry all parts exposed to it, it erodes the sand from round the roots in some places, and it buries plants with sand in other places.

Summing up these factors, we have a dry soil and exposure to great extremes of temperature, to intense light and to strong winds,

making up altogether an extremely unfavourable habitat for plants. We shall now consider briefly how these severe conditions are met by the plants composing the flora of the dunes.

In the first place, most of them exhibit an extensive root system which enables them to make the most of a scanty supply of moisture. How extensive this root system was in the case of the trees which at



Fig. 8.—PORTION OF WINDWARD SLOPE COVERED WITH
AMMOPHILA ARENARIA.

one time grew upon the old fixed dunes can be clearly seen to-day, now the sand is eroded from round the roots, as slender roots extend for great distances in every direction over what is now the surface of the sand.

Then plants growing upon shifting dunes must have the power of rapid vertical elongation, so as to be able to keep above the sand as it is piled in around them. This is possessed in a marked degree by *Ammophila arenaria*, *Salix syrticola*, *Salix glaucophylla* and *Cornus stolonifera*, and in a less degree by *Prunus pumila*.

Transpiration is retarded by the development of thick leaves, or by leaves covered with hairs, which produce a dead hair-space at the leaf-surface. Of the plants on the Wellington dunes, *Salix glaucophylla*, *Cakile edentula*, *Lathyrus maritimus* and *Thuja occidentalis* possess thick leaves, and *Artemisia caudata* and *Salix syrticola* have hairy leaves.



Fig. 9.—ROUNDED, SUPERIMPOSED DUNES, FORMED BY
VITIS VULPINA.

The dune area near Wellington may be divided into four main plant habitats : the shifting dunes, the rejuvenated dunes, the barrier beach and the moist sandy flats.

Of the shifting dunes, some are advancing rapidly ; others more slowly. Upon the crest of the former, vegetation is practically nil,



Fig. 10.—SUPERIMPOSED DUNES FORMED BY *SALIX SYRTICOLA*
IN BACKGROUND.
SEEDLINGS OF THE WILLOW IN FOREGROUND.

there being only an occasional plant of *Cakile edentula* and *Artemisia caudata*. Upon the windward slope of these active dunes large patches of *Ammophila arenaria* occur (Fig. 8).

On the shifting dunes which are not moving so rapidly there occur superimposed, rounded dunes formed by *Vitis vulpina* (Fig. 9), others formed by *Salix glaucophylla* and *Salix syrticola* (Fig. 10), and patches of *Lathyrus maritimus* (Fig. 11).

The lee slopes of the rapidly-moving dunes are bare (Fig. 12), but those of the more slowly advancing dunes are being captured by

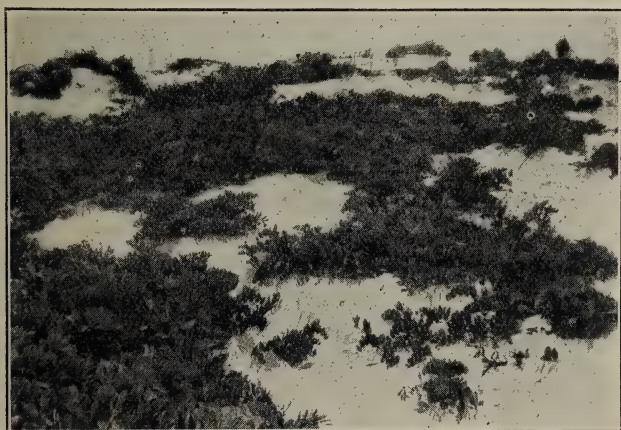


Fig. 11.—*LATHYRUS MARITIMUS* ACTING AS A SAND-BINDER.

Artemisia caudata, *Cornus stolonifera*, *Salix syrticola*, *Rhus toxicodendron*, and *Equisetum arrense* (Fig. 13).

In the area of rejuvenated dunes there are high peaks with wind-sweeps and small dunes between them (Fig. 14), and the vegetation consists of *Thuja occidentalis*, *Populus deltoides*, *Populus tremuloides*, *Salix syrticola*, *Prunus pumila*, *Ammophila arenaria*, *Elymus canadensis*, *Sporobolus cryptandrus*, *Vitis vulpina*, *Cornus stolonifera*, *Artemisia caudata*, and *Cakile edentula*. The following mesophytes still persist in this area:—*Prunus virginiana*, *Salix lucida*, *Rosa blanda*, and *Smilacina stellata*.

On the barrier beach, which consists of shingle towards Lake Ontario, and of sand on the West Lake side, the vegetation is composed



Fig. 12.—STEEP AND BARE LEE SLOPE ADVANCING UPON A FIELD. of:—*Salix syrticola*, *Populus deltoides*, *Populus tremuloides*, *Artemisia caudata*, *Juncus balticus littoralis*, *Scirpus americanus*, *Potentilla anserina*, and *Equisetum littorale*.

The sandy flats, between the beach and the dunes, from which the sand has been eroded down to the level of the lake, is not of course now a xerophytic habitat at all, as in spring and early summer they



Fig. 13.—SLOWLY ADVANCING IN-SLOPE BEING CAPTURED BY VEGETATION.



Fig. 14.—REMAINS OF OLD FIXED DUNE.



Fig. 15.—A UNIQUE FLOWER-POT.
ARTEMISIA CAUDATA GROWING
IN AN OLD CEDAR STUMP.

are covered with water, and even in late summer and fall are moist. Their flora is naturally the richest of any in the dune area, and consists of *Solidago graminifolia*, *Gerardia paupercula*, *Lobelia kalmii*, *Potentilla anserina*, *Salix syrticola* of which seedlings are abundant, *Cakile edentula*, *Triglochin palustris*, *Panicum capillare*, *Scirpus pauciflorus*, *Eleocharis acuminata*, *Carex oederi*, *Juncus balticus littoralis*, *Scirpus americanus*, *Scirpus validus*, *Euphorbia polygonifolia*, and *Artemisia caudata*.

At numerous points on the dunes unique "flower-pots" are to be seen. These consist of plants of *Artemisia caudata* growing in old cedar stumps (Fig. 15).

Queen's University, Kingston, Ont.

Food Habits of the Bullfrog.

BY E. W. CALVERT, O.A.C., GUELPH.

AT one of the winter meetings of the Entomological Society, Dr. Be-thune exhibited a jar containing a bullfrog and a swallow. The frog had been cut open, and the remains of the swallow protruded from it. Owing to the condition of the bird, it seems impossible to determine its species.

Upon inquiry, it was learned that J. A. Stewart, a city boy, while catching bullfrogs in a pond near Arkell, discovered this one with the wing-quills sticking out of his mouth, and further investigation showed that the swallow was dead. The frog was as lively as the others, and did not seem to experience any inconvenience. Swallows were very abundant there, and bullfrogs had been seen jumping at them, apparently, by residents of the locality.

Mary C. Dickerson, in the "Frog Book," says:—"The bullfrog feeds upon the insects and other small life of the pond, but this does not make up the greater part of his food. He is the green dragon of the pond to the fish, the small turtles, the young water birds, and alas! to the frogs also. The bullfrog will eat any moving objects that he can swallow, or partially swallow. It does not take long to find out the cannibalistic traits of this frog, and to learn that we must not keep a large specimen in the same place with the smaller frogs." . . .

"If a sparrow comes for its daily bath beside what seems to be a moss-covered stone, its brown tail-feathers are seen a moment later protruding from the frog's mouth, while the frog is sitting sedately in just the same spot. Sometimes a bird drops from the overhanging bough above, because of the correct aim of some gunner, and becomes a trophy for the frog instead of for the man."

The Standard Library of Natural History remarks:—"While the British frog contents itself with a diet of slugs, worms, beetles and other insects, the bullfrog aspires to larger quarry, and has an especial *penchant* for young ducklings."

Mr. J. H. Fleming, of Toronto, says:—"It is a curious story, that of the bullfrog and the swallow. First of all, it is not by any means improbable, as bullfrogs are pretty nearly omnivorous. I know of a case of one swallowing a small garter-snake, and anyone who has fed them with angle-worms, raw meat, etc., can believe anything of

their capacity. Several years ago there was a very large bullfrog in the London Zoo that the keeper said he had just given a white rat to, and that he fed white mice to a toad. . . . A swallow is a very likely thing to get within reach of a bullfrog. They often skim low over the water, and, after all, bullfrogs are pretty active when hungry.

Again, Mr. W. E. Saunders, of London, says:—"I cannot say that I have actually known of such an occurrence before, but it is quite creditable. Frogs are known to eat everything they can catch, and you know how a swallow will hover over the water, and close to it, picking up flies. A bird so hovering could easily be caught by a frog."

It seems evident from the above that the bullfrog is at least occasionally carnivorous, but owing to the fact that its habits are studied by so few, such incidents as this one are seldom recorded.

The Edible Toadstools—The Smooth Lepiota.

BY B. W. A. McCUBBIN, M.A., O.A.C., GUELPH.

WHEN the long, dewy nights and frequent rains of late summer have brought about a considerable increase in the surface moisture of the soil, all sorts of fungi find favourable conditions for growth, and enter on a vigorous vegetative period. Throughout the hot, dry summer the thread-like filaments of their underground growth have either been entirely killed, or have lain dormant in the damper parts of the soil. With the coming of the welcome moisture, however, this mycelium takes on a new lease of life. It increases at an astonishing rate, penetrates the soil in all directions, and forms here and there those clumps of compact tissue which we are familiar with in the common mushroom as "buttons." After a period of rest the buttons begin to grow, and now their development proceeds so rapidly that they burst from the ground, and attain their final size in the course of a few days or even hours.

Of the innumerable species of fungi which follow this method of growth, and are popularly designated as toadstools, a very large proportion are edible, the number of really poisonous forms being exceedingly small. Captain McIlwaine* has listed one thousand species in

* McIlwaine—"One Thousand American Fungi."

America, of which seven hundred are said to be edible ; and of the remaining three hundred only about a score are certainly known to be poisonous, the remainder having not yet been tested. Among this vast number of edible forms, many are to be found which, from their scarcity, small size, uninviting appearance, or woody texture, are of comparatively little value for food purposes. But leaving these out of consideration, there still remain many dozens, or even scores, of so-called toadstools which, if their delicate flavors were known, and their harmlessness assured, would be eagerly sought for by those who possess discriminating palates.

One of the commonest and best of these is the Smooth Lepiota (*Lepiota naucina*, Fr.), which abounds in lawns and pastures during



THE SMOOTH LEPIOTA.

the late summer and early autumn. It appears year after year in considerable quantities during September and October on the O.A.C. lawn at Guelph. It is especially abundant around and under clumps of Norway Spruce, where I suppose its mycelium is better protected from drought during the summer. It is not uncommon in open woods,

and I find it frequently under cedars in the rather damp bottom lands along the river. In grassy pastures and lawns, however, it seems to thrive best, and here reaches its greatest size.

The Smooth Lepiota is, of all the edible toadstools, the most easily recognized. The delicate, chalk-like whiteness of its stalk and cap are very striking. Its cap has a soft, satiny skin, which may become somewhat buff or tan-colored, or may break up into scale-like fragments, as shown in the accompanying photograph. The gills are white, and though they are said to turn dull pinkish with age, I have not often seen it in this condition. The ring is usually conspicuous. Sometimes it becomes loose, and may be moved up and down the stem. The stem separates easily from the cap, and is usually characterized by a bulbous base. Atkinson gives the following description:—*“Lepiota naucina, Fr.—Edible. The smooth lepiota, L. naucina, grows in lawns, in pastures, and by roadsides, etc. It occurs during the latter part of summer and during autumn, being more abundant in September and early October. It is entirely white, or the cap is sometimes buff, and in age the gills become dirty pink in color. It is from 8—12 cm. high, the cap 5—10 cm. broad, and the stem 8—15 mm. in thickness.”*

The Smooth Lepiota is sometimes mistaken for the common Field Mushroom (*Agaricus campestris*), on account of the occasional pinkish tinge in the gills. Such a mistake is, of course, quite a harmless one. It is a far more serious matter, however, in the case of the Deadly Amanita (*Amanita phalloides*), the white variety of which bears much resemblance to this Lepiota, and might be collected by beginners in mistake for the latter. The Deadly Amanita has white gills, but its stalk is usually longer and thinner, and its bulbous base has a more or less well-marked volva or cup, whereas the bulbous base of the Lepiota stem is perfectly smooth. Atkinson's warning in regard to the Deadly Amanita may well be quoted here:—*“Since the Amanita phalloides occurs usually in woods, or along borders of woods, there is little danger of confounding it with edible mushrooms collected in lawns distant from the woods, and in open fields. However, it does occur in lawns bordering on woods, and in the summer of 1899 I found several of the white forms of this species in a lawn distant from the woods. This should cause beginners and those not thoroughly familiar with the appearance of the plant to be extremely cautious against eating*

mushrooms simply because they were not collected in or near the woods. Furthermore, sometimes the white form of the Deadly Amanita possesses a faint tinge of pink in the gills, which might lead the novice to mistake it for the common mushroom. The bulb of the Deadly Amanita is usually inserted quite deep in the soil or leaf mould, and specimens are often picked leaving the very important character of the volva in the ground, and then the plant may be easily taken for the common mushroom, or more likely for the Smooth Lepiota (*Lepiota naucina*), which is entirely white, the gills only in age showing a faint pink tinge. It is very important, therefore, that, until one has such familiarity with these plants that they are easily recognized in the absence of some of these characters, the stem should be carefully dug from the soil."

In spite of its resemblance to the extremely undesirable Amanita, the Smooth Lepiota is quite easily recognized by anyone who has once seen it growing. And it is so plentiful in its season, is so daintily attractive, and of such excellent flavor, that it seems a pity not to have it occupy the place in public esteem that its qualities deserve.

Weed Migration.

BY F. MITCHELL, INNERKIP, ONTARIO.

THE circumstances connected with the natural migration of plants are always interesting to the field botanist. Weeds are, of course, the most enterprising migrants; indeed, it is their enterprise, if the word may be allowed, which qualifies them to enter the class. As a rule, they follow closely in the footsteps of the pioneer agriculturist. It seems, therefore, to be a strange fact that in the recently opened prairie provinces they are more numerous and pestiferous than in the longer-settled parts of the country. The openness of the prairie, the cosmopolitanism of the settlers, and the consequent widely distributed sources of seed-supply, are not the only reasons that have contributed to the result. The fact remains that a number of important weed immigrants have landed in the West, established themselves, and are now travelling back to the Provinces which they overleaped.

It is not many years since the first plant of Prickly Lettuce was reported in Ontario. I do not know that there is an older Canadian

specimen than one in my collection taken at Walkerville, Ontario, in July, 1891. To-day there is probably not a mile of railway in the country which has not furnished a distributing point for its seed. In August, 1894, an introduction of Russian Thistle was reported on the Grand Trunk Railway, in the Township of Tilbury East. Shortly thereafter I was instructed by the Division Superintendent, and afforded means of carrying out the instruction, to visit the locality, make a collection of specimens, and proceed to interview every section foreman in the division as far as Windsor, leaving a specimen with him, and explaining directions previously sent for the eradication of the weed, in case it should be found in his section. Not one of them or of their men who were usually with them had previously noticed a specimen. Russian Thistle has ceased to be a novelty to Ontario track-men in whose sections there is a grain elevator or a point of transshipment. In the large shunting grounds east of this city (London, Ont.), it is the most conspicuous plant feature of the area.

These and similar plants may have come to the continent by boat, but, once here, they usually travel by rail. Car-wheels catch and carry the plumed seeds, and heavier ones steal rides as stow-aways in litter and coarse grains. In the season just closed (1911), I collected along the C.P.R., within a distance of three miles from the London depot, the following immigrants that had evidently travelled by the means just mentioned:—

Tar-weed (*Grindelia squarrosa*), (Pursh.)

Hare's-ear Mustard (*Coringia orientalis*), (L.)

Three-hedge Mustards:—

Sisymbrium incisum (Engelm.)

“ *canescens* (Nutt.)

“ *sophia* (L.)

(The last-named has ceased to be rare around railway freight-sheds throughout the country.)

Dragon Head (*Dracocephalum parviflorum*) (Nutt.)

Velvet Grass (*Holcus lanatus*) (L.)

Nimble Will (*Muhlenbergia schreberi*) (J. F. Gmel.)

Spreading Vervain (*Verbena bracteosa*) (Michx.)

An Addition to the List of Toronto Butterflies.

BY ARTHUR GIBSON, OTTAWA.

Since the publication of the list of the Butterflies of Toronto, which appeared in the Ontario Natural Science Bulletin, No. 6, 1910, the undersigned has had reported to him the capture of a specimen of *Argynnis idalia*, Drury. This was taken on Forest Hill Road, Toronto, towards the end of August, by Mr. J. Ronald McMurrich, and is the first record for the district.

In an article, "Observations on the Season of 1895," in the Annual Report of the Entomological Society of Ontario, for 1895, the late Mr. J. Alston Moffat refers to a specimen of *Argynnis idalia* which was captured at Windsor, Ont., by Mr. W. S. Cody. This, the first record for Canada, is also included in Dr. Bethune's additional paper on "The Butterflies of the Eastern Provinces of Canada," (Rep. Ent. Soc., Ont., 1896). In this latter paper the following record also occurs: "St. John, N.B., (H. E. Goold). Since 1896 this butterfly has been taken in Canada at Awemee, Man., 1902, (N. Criddle), and at Grand Bend, Lake Huron, Ont., July, 1903, (H. S. Saunders).

The above are all the Canadian records I know of.

Notes on the Mammals of the Bruce Peninsula.

BY A. B. KLUGH, M.A.

THE Bruce Peninsula lies between Lake Huron and Georgian Bay in Ontario. The lower part of the Peninsula contains a considerable amount of cultivated land; while much of the lower part, and nearly the entire upper portion, is covered by Maple-Beech forest, scrub, cedar swamp, and swales. For a fuller discussion of the plants of the peninsula, the reader is referred to "The Plant Formations of the Bruce Peninsula," in this number of the *Bulletin*.

The most interesting fact brought out in a study of the Mammalia of this locality is that the Peninsula is a northward extension of a southern fauna, and instead of finding forms characteristic of the Canadian Faunal Zone, we find forms of the Alleghanian Faunal Area. This same fact is brought out by a study of the flora, and to a less marked degree by the Avifauna.

These notes are not presented as a complete list of the Mammals of this locality, since I have done but little trapping on the Peninsula, and undoubtedly species occur which have not come to my notice.

Odocoileus virginianus borealis. Northern Deer.—No longer found in the southern portion of the Peninsula, except as an occasional visitor. Still frequent in the northern part of the Peninsula.

Lepus americanus virginianus. Varying Hare.—Very common in the scrub country of the interior and in the Cedar swamps. Along the roads through the scrub country I have often seen four in sight at once, sitting out at different points along the road. In the winter they have definite trails in the Cedar swamps, along which they browse on the Cedar.

Erethizon dorsatus. Canada Porcupine.—Scarce in the south, and apparently not very common in the north of the Peninsula.

Evotomys gapperi. Red-backed Mouse.—This species is not uncommon in the woods.

Microtus pennsylvanicus. Field Mouse.—Common in field, particularly along their edges, where they make their burrows under fences, stumps and bush-piles.

Fiber zibethicus. Muskrat.—Not very commonly met with on the Peninsula, because of the lack of marshes and reed-margined rivers. I have seen their houses on the Paltamelly River, between Lake Isaac and Spry Lake.

Peromyscus leucopus. White-footed Mouse.—Abundant in woods, though seldom seen except as a brown flash as it darts from one place of concealment to another, and its commonness consequently remains unsuspected until one starts trapping. It is interesting to note that it is this species, which is found in the Alleghanian and Carolinian faunal areas, and not *Peromyscus canadensis*, characteristic of the Canadian Zone, which occurs on the Peninsula. One specimen, taken on May 8th, 1911, contained six embryos in an early stage of development. A number of half-grown young were caught during May. They are plumbeous gray above, and white beneath.

Arctomys monax canadensis. Groundhog.—Very common throughout the Peninsula in woods and fields, and particularly in the scrub country.

Tamias striatus lysteri. Chipmunk.—Very common along borders of fields and in woods.

Sciurus carolinensis leucotis. Gray Squirrel.—Rare ; I have only seen one specimen of this species on the Peninsula, and that was a black individual.

Sciurus hudsonicus gymnicus. Red Squirrel.—Very common in woods.

Condylura cristata. Star-nosed Mole.—This is the only Mole that I have seen specimens of on the Peninsula.

Mephitis Mephitis. Skunk.—Fairly common.

Putorius vison. Mink.—Fairly common, particularly along the shore of Georgian Bay.

Putorius cicognani. Bonaparte's Weasel.—This is the only Weasel that I have seen on the Peninsula.

Procyon lotor. Raccoon.—Fairly common.

Ursus Americanus. Black Bear.—Once fairly common, and still seen occasionally. I have come across their trails in the tall timber of the interior ; also rotten logs, which they had ripped to pieces in their hunt for insects. In 1905 one was seen drinking from the Bay, near the village of Colpoy's Bay, at the base of the Peninsula ; and in 1907 a bear and cub were seen crossing a field a few miles from the village.

Vulpes fulvus. Red Fox.—Common throughout the Peninsula.

Lynx ruffus. Wild cat.—The few specimens of *Felidae* which I have been able to examine from the Peninsula all proved to be this species, and not the more Northern *Lynx canadensis*.

Queen's University,
Kingston, Ont.

The Yellow-breasted Chat at Alma, Ontario.

ON December 12th, 1911, Mr. Wm. French (at his house about two miles south of Alma, Wellington County, Ontario) picked up the head and body of a decapitated bird on his verandah. He says it wasn't there on the 10th, but that it may have been on the roof, and been blown down by the wind. In that case, he couldn't say how

long it had been there. It could not have been there long though, as the feathers and body looked quite fresh when found. He sent the bird to me, and I identified it as a Yellow-breasted Chat (*Icteria virens*), and sent it to Professor A. B. Klugh, of Queen's University, who confirmed my identification.

The Yellow-breasted Chat has been recorded from Hamilton, Ont., by Mr. McIlwraith, and has been found to be a fairly common breeder at Point Pelee, Essex County, Ont., but its occurrence at Alma is, so far, our most northern record.

JOHN ALLAN, JUNIOR.

ALMA.

A Note.

It is well-known that the oaks in species and hybrids are richly represented along the southern shores of Lake Huron. Last October, when attending the West Lambton Teachers' Institute, I used the opportunity to do a little botanizing in the region referred to. One reward was the discovery of a Hill's Oak (*Quercus ellipsoidalis*, Hill). If this species has previously been reported in Canada I am not aware of the fact. The tree resembles the Pin Oak, but it is characterized by its acorns having deep cupules with perberulent ashy-brown bracts. I found also some patches of the Terebinthin Ragweed (*Ambrosia psilostachya*, D.C.). I have seen this plant on the prairie, but never before in Ontario.

F. MITCHELL,

Innerkip, Ont.

Notes on the Winter Birds at Guelph, Ontario, in 1911--12.

THE following permanent residents are with us this winter:—
Ruffed Grouse, Screech Owl, Hairy Woodpecker, Downy Woodpecker, Brown Creeper, White-breasted Nuthatch, Chickadee and Golden-crowned Kinglet.

Snow Buntings are as common as usual; while Redpolls have

been noted by Prof. Crow and Mr. Caesar ; and Pine Finches appear to be quite common.

A Red-breasted Nuthatch and four Purple Finches were seen on Dec. 22, Juncos on Dec. 22 and in January, and a Robin on the College Campus on Jan. 4.

Ducks of at least two species have been seen on Dec. 30, early in January, and on Jan. 29.

E. W. CALVERT.

O. A. C., GUELPH, ONT.

A Late Migration of the Evening Grosbeak in Ontario.

TO see the Evening Grosbeak in winter, or in the sunshine of a March day, is not an unusual sight ; but to see it in May, with Warblers flitting and singing in its immediate vicinity, strikes the ornithologist as incongruous.

But this was the sight accorded to me on May 8th, 1911, in the second growth below the limestone bluffs at Colpoy's Bay, Ont.

There were seventeen of these handsome birds in the scattered flock—nine males and eight females.

They were feeding on the ground upon the fallen fruits of *Rhus typhina* (Sumac), and were much more wary of approach than in the winter. When disturbed, they flew into the trees, and remained so still that their presence would have been hard to detect but for their loud-whistled call-note, repeated at intervals.

On May 9th they were still in the same locality, but had disappeared by May 11th.

A. B. KLUGH.

Queen's University,
Kingston, Ont.

A Chipping Sparrow's Nest on the Ground.

On May 20, 1911, I found the nest of a Chipping Sparrow (*Spizella socialis*) on the ground among Red Clover, at the edge of an orchard, at Oakville, Ont.

J. W. NOBLE,

O. A. C., Guelph.

A Large Colony of Bank Swallows' Nests.

In the clay banks along Lake Ontario, some three miles east of Oakville, is situated a large colony of Bank Swallows' Nests. These are so numerous that several hundred nesting holes were counted in a few yards. Probably in no locality in the Province are Bank Swallows more abundant.

J. W. NOBLE,

O. A. C., Guelph.

The Hydrophytic Formations of Lake Opinicon.

LAKE Opinicon is an expansion on the Rideau Canal about 30 miles from Kingston, Ont. The lake now covers a far greater area than it did before the construction of the canal system and a large part of it is made up of "drowned lands" where the stumps of trees project above the water. The water over the greater portion of the lake is very shallow, thus favouring the abundant development of hydrophytes of the Limnaea formation which grow with their roots in the soil at the bottom. This formation is composed of *Vallisneria spiralis*, the staminate flowers of which were floating all over the surface of the water at the time of my visit on Aug. 11th and 12th, *Elodea canadensis*. *Bidens beckii*, which was in flower, *Najas flexilis*, *Potamogeton pectinatus*, *Potamogeton amplifolius*, *Potamogeton perfoliatus*, *Potamogeton zosterifolius*, *Potamogeton friesii* and *Potamogeton natans*. On the stems and leaves of these plants were several epiphytic Algae—*Colevchaete orbicularis*, *Coleochaete soluta*, *Dichothrix horsfordii* and *Tolopothrix tenuis*.

Among the fixed plants of the Limnaea formation were two representatives of the floating Pleuston formation—*Ceratophyllum demersum* and *Lemna trisulca*. Among these larger plants floated the following members of the Plankton formation—*Coelosphaerium kuetzingianum*, *Tetraedron minimum*, *Scenedesmus bijuga*, *Scenedesmus quadricauda*, *Coelastrum microporum*, *Pediastrum boryanum*, *Pediastrum duplex* and *Pediastrum tetras*.

A. B. KLUGH

Queen's University,
Kingston, Ont.

Spring Bird Notes From Oakville, Ontario.

ALTHOUGH birds, as a class, seemed to be less numerous than usual, a few species of unusual occurrence have been noted. Red Crossbills (*Loxia curvirostra minor*) were much in evidence throughout the greater part of April and May, and were last seen on May 25.

On May 7 I saw a Prairie Warbler (*Deudroica discolor*), satisfactorily for identification, in an orchard along the lake, and on May 14 another, some two miles inland.

In a pasture-field on May 14 were seen a pair of Upland Plovers (*Bartramia longicauda*), and these were seen twice again in the same field during the month.

E. W. CALVERT.

O. A. C., GUELPH, ONT.

A Zonal Algal Habitat.

ON the shore of Colpoy's Bay, near Oxenden, Gray County, Ontario, on June 3rd, 1911, I came across an algal habitat with a marked Zonal arrangement.

There were two shelves of flat limestone rock over the first of which a very shallow stream of water flowed into the bay. On the top and front face of the first shelf were pinkish gelatinous nodules of *Palmella miniata*, Leiblein and greenish nodules of *Nostoc verrucosum*, Vaucher. The second shelf was submerged and had a luxuriant growth of *Cladophora keutzingiana*, Grunow.

Beyond this shelf, on the rocks in the bay, was a zone of *Ulothrix sonata*, Kuetzing.

A. B. KLUGH

Queen's University,
Kingston, Ont.

Publications Received.

MOSSES with a Hand-lens and Microscope by A. J. Grout, Ph. D.
The O. T. Louis, Co., New York.

Now that Plant Ecology has taken its place as an essential part of Botany it is important that the lower plants found in the various formations should be studied as well as the higher forms. Hitherto we have had no book by which the ecologist could readily identify the Mosses—a group which have a prominent place in many associations, but Dr. Grout has now supplied this need.

In this volume about 300 species are described, among this number being all the common and some of the rarer Mosses of the eastern United States and eastern Canada. Excellent keys to the families, sub-families genera and species are given.

In the first portion of the book the subjects of Classification and Nomenclature, Collection and Preservation of Mosses, and Methods of Manipulation are treated and the Life History and Structure of the Moss Plant is fully discussed and excellently illustrated.

The structure of mosses differs so greatly from that of the higher plants that a host of new terms confront the neophyte in moss-study, but the full and well-illustrated glossary removes the difficulty.

The illustrations are extremely numerous and excellent in every way.

This volume is a quarto of 416 pages and is printed in large clear type on fine coated paper.

A. B. K.

MOSSES with a Hand-lens, by Dr. A. J. Grout. Second Edition.
The O. T. Louis, Co., New York.

For those who wish to study the Mosses, but have only a hand-lens as equipment, this book is indispensable. It contains keys to the families, the genera and the species of the common mosses of eastern North America. Each species is described and the majority of them are illustrated. This book also contains keys to, and descriptions and cuts of, 54 common Liverworts. The sections devoted to the method of examining mosses, their collection and preservation and on life history and structure are excellent. Thirteen pages are devoted to a well-illustrated glossary.

The first edition which dealt with a smaller number of Mosses and included no Liverworts has proved so useful both in schools and colleges and to individual collectors that a wide sale is assured for this much improved edition.

A. B. K.

THE LICHENS OF MINNESOTA: Contributions from the United States National Herbarium, Vol. 14, Part I, by BRUCE FINK.

IN this volume of 269 pages, Prof. Bruce Fink gives us a work of immense value to the botanists of Ontario, for although, as the title indicates, it deals primarily with the lichens of Minnesota, the great majority of the species described are common to the two districts. This report is no mere catalogue of the lichens of a single state, for in the first portion the structure of lichens, their methods of reproduction, and their economic importance, are fully discussed. Then follows a most excellent key to the genera; while the rest of the volume is taken up with keys to the species of each genus, descriptions of the species, together with their habitats and ranges, both in Minnesota and elsewhere. Under each family and genus, the affinities of the groups are carefully discussed. In the descriptions of the species, a most commendable feature is the data given as to variations in size of thallus and size of spores, for in many works spores are given as 12 microns by 8 microns, when they may in reality be 10—14 microns by 7—9 microns, thus implying a constancy which does not exist. The illustrations reproduced from photographs of lichens in their haunts are particularly good.

A. B. K.

THE MISSOURI BOTANICAL GARDEN: Twenty-first Annual Report (1910).

In this report some very valuable scientific papers appear. In "Periodicity in *Spirogyra*, with Special Reference to the Work of Benecke," C. H. Danforth shows that, as far as the common Missouri species of *Spirogyra* are concerned, Benecke's conclusions that conjugation is brought about by a lack of nitrogen in the water, are not borne out. E. G. Arzberger's paper on "The Fungous Root-tubercles of *Ceanothus americanus*, *Elacagnus argentea*, and *Myrica cerifera*," is a valuable contribution to our knowledge of *mycorrhizae*. Some of his

conclusions are as follows:—*Ceanothus*: The infection of this plant by the fungus is quite universal. Internal infection occurs in the growing region, and takes place by the fungus passing from cell to cell. Because of infection, hypertrophied cells and nuclei are formed. The fungus dissolves the walls of the host cell. Following the vesicular stage, the cytoplasm and nucleus of the host cell are absorbed. Subsequent to this, the cell content of the fungus disappears. Both the host cell and the fungus finally die, and undissolved portions of the fungus remain in the cell. Symbiosis exists, which is quite apparent in the early stage. *Elaeagnus*: External and internal infection takes place, as in *Ceanothus*. The fungal mycelium differs from that of *Ceanothus*, in being very narrow and branching profusely. The walls of the host cell are not broken down. Hypertrophied cells and nuclei are formed, but the nucleo-cytoplasmic relationship is maintained in the infected cells. *Myrica*: All species of *Myrica* possess tubercles. The fungus confines itself to one or two layers of cells, and internal infection takes place acropetally. No hypertrophy or symbiotic relationship exists. The fungus is best regarded as a parasite. The form, structure, and behaviour of the fungus indicate that it belongs to the genus *Actinomyces*. Arzberger also finds that the tubercles of *Alnus* and *Ceanothus* contain enzymes capable of digesting fibrin.

F. E. Lloyd's paper on "Development and Nutrition of the Embryo, Seed and Carpel in the Date, *Phoenix dactylifera*, L.," is a good contribution to plant embryology.

These and other papers make up an extremely interesting volume.

A. B. K.

RHODORA: Journal of the New England Botanical Club, Vol. 12, Nos. 134—144.

During the past year, many articles of much value to Ontario botanists have appeared in this magazine, among the most important being:—"A Synopsis of the Species of *Arctium* in North America," by M. L. Fernald and K. M. Wiegand; "The North American Variations of *Lycopodium clavatum*," by M. L. Fernald and C. H. Bissell; "*Agropyrum caninum* and its North American Allies," by A. S. Pease and A. H. Moore; "The Variations of *Lonicera caerulea* in Eastern America," by M. L. Fernald and K. M. Wiegand, in which a new

variety—*Lonicera caerulea calvescens*—is described ; and one Ontario station, Mer Blue, near Ottawa, is cited. "The Use of Corrugated Paper Boards in Drying Plants," by J. F. Collins, is an article of great interest to the field botanist. This method of dry plant is, briefly, to use a sheet of either single-faced or double-faced corrugated card-board between each pair of dryers in the press, and to hang up the press over a lamp or stove. For very rapid drying, a "chimney" of wood or cotton should be placed over the source of heat, and the press placed in this "chimney" in such a way that the grooves of the card-board run vertically. Mr. Collins claims the following advantages for this method :—(1) That there is no necessity of changing dryers ; (2) that dryers need not be spread out to dry ; (3) that colors of flowers and foliage are more perfectly preserved ; (4) that plants which formerly took a week to dry, can almost invariably be perfectly dried in less than 24 hours, and commonly in less than twelve hours. It has also been found that by using the corrugated card-board without applying artificial heat, plants may be left till dry without changing dryers, without any danger of mildew or blackening, though of course in this case the drying is not so rapid.

A. B. K.

BIRD LORE : Vol. XII., Nos. 2—6.

This volume of Bird-Lore contains many articles of great interest to bird-students. To those of us who have known the grand bird in its northern solitudes, E. W. Vicker's "The Pileated Woodpeckers" appeals strongly. In "A New Departure for the Redwing," H. H. Cleaves tells of Red-winged Blackbirds nesting in a meadow on Staten Island, N.Y. Cordelia J. Stanwood, in "The Hermit Thrush : the Voice of the Northern Woods," gives us an intimate study of this beautiful songster, "The Nesting of Heyburn's Rosy Finch," by Dr. C. S. Moody, describes the nesting habits of this bird, of which little was previously known. "The Black-billed Cuckoo at Home" is a well-illustrated article by E. J. Sawyer. The way in which a House-Wren learned to carry twigs into her nest through a hole end-ways, instead of maintaining her hold on the middle of the twig, is described by C. S. Thoms. "A Record of the Outcome of Seventy-five Birds' Nests," by R. H. Wheeler, is a careful account of what happened to each of these nests. In forty-three of these, young were

successfully raised ; while the causes of failure in the case of the other 33 are given. The colored plates and photographs of this volume are fully up to the high standard of excellence set by previous volumes of Bird-Lore.

A. B. K.

THE WILSON BULLETIN : Nos. 70—73.

In these numbers, Dr. Lynds Jones' "The Birds of Cedar Point and Vicinity" is brought to a conclusion. These notes are of much interest to Ontario ornithologists, because the region they cover is but a few miles across Lake Erie from Point Pelee, where the members of the Great Lakes Ornithological Club have been at work for five years, and are still actively engaged in studying bird migration. In "Bird Migration at Point Pelee, Ontario, in the Fall of 1909," N. A. Wood adds further notes on the avifauna of this interesting station. "At the Sign of the Northern Flicker," by Althea R. Sherman, is a splendid contribution to the life-history of the Flicker. The *Bulletin* is publishing an increasing number of good, short notes on the birds of Ohio and the surrounding region.

A. B. K.

CASSINIA : A Bird Annual. 1910.

This volume, which is published as the official organ of the Delaware Valley Ornithological Club, contains much of interest to the bird-student. The migration report for the Delaware Valley is very full and complete, and among the numerous contributions are :—"Breeding of the Raven in Pennsylvania," by Richard C. Harlow ; "The Wood Thrush," by Cornelius Weygandt ; and a sketch of William Gambel, M.D., by Witmer Stone.

THE OTTAWA NATURALIST : Vol. XXIV., Nos. 1—12.

An article of much interest to Ontario botanists is "Fern Hunting in Ontario," by F. S. A. Morris, which runs through three numbers of the *Naturalist*. In No. 7, H. Groh gives us a "Preliminary List of the Crataegi of the Ottawa District." In No. 10 F. S. A. Morris writes on "Club-mosses." The following ornithological articles appear :—"The Birds of Ottawa," by C. W. G. Eifrig ; "Bird Migration in Northern British Columbia," by Rev. J. H. Keen ; "Notes on

the White-throated Sparrow," by L. McI. Terrill; "A Colony of Cliff Swallows and Others," by Norman Criddle; and "Nesting of the American Osprey," by W. J. Brown. Other articles on Palaeontology, Geology, Entomology, Conservation, &c., make up an interesting volume.

A. B. K.

THE FERN BULLETIN: Vol. XVIII., Nos. 1-4.

These numbers of the Fern Bulletin are full of interesting matter for the fern-student. In "Variation in *Botrychium ramosum*," Raynal Dodge discusses the effect of environment upon the forms of *Botrychium*. Adella Prescott writes on "Juvenile Ferns." In "Fern Notes," E. J. Hill discusses the distribution and ecology of several species. Otto E. Jennings contributes "Notes on the Distribution of Certain Plants in Western Pennsylvania." There are the usual interesting short notes and the same clear-cut, forceful editorials which have always been a feature of this magazine.

A. B. K.

THE MARINE AND ESTURINE DIATOMS OF THE NEW BRUNSWICK COAST: By L. W. Bailey, LL.D., F.R.C.S. Reprinted from the Bulletin of the Natural History Society of New Brunswick. Vol. VI. 1910.

In this paper Dr. Bailey treats of the distribution of the Diatoms of the New Brunswick Coast of the Bay of Fundy and the lower portions of the St. John River, the Kennebecasis and the St. Croix Rivers. He shows that in the estuaries there is a remarkable mingling of marine and fresh-water forms. There are two plates illustrating the genera, which, however, do not do justice to the author's excellent drawings which we have had the pleasure of examining.

A. B. K.

NYSSA SYLVATICA (MARSH): By Theo. Holm. Reprinted from the American Midland Naturalist, pp. 128-137.

In this little monograph Dr. Theo Holm gives us an excellent piece of work upon the histology of the roots, stems and leaves of this plant, and also a study of the seedlings. It is well illustrated by the author.

A. B. K.

THE JOURNAL OF THE MAINE ORNITHOLOGICAL SOCIETY: Vol. XII.

This journal continues to reflect the active work done by the society, which is rapidly increasing its membership. The new editor, Mr. Louis E. Legge, is to be congratulated upon the appearance of this volume.

A. B. K.

MINNESOTA ALGAE: Vol. I. The Myxophyceae of North America and Adjacent Regions. By Josephine Tilden.

American botanists have long wanted such a book as this, to enable them to identify the Blue-green Algae, and its publication should give an impetus to the study of these small, but interesting and important forms of plant life. In this volume Prof. Tilden gives descriptions of 544 species of *Cyanophyceae*, and supplies keys to the orders, families, genera and species. This work covers an extremely wide range—from the Arctic Circle to Central America, including the West Indies, Bermuda, and Hawaii. A most commendable feature is the full citation of the localities from which each species has been recorded, and the quotation of dates of collection. In the twenty excellent plates—the work of Miss Charlotte Waugh—most of the species are figured. The index is very full, and a glossary of algological terms is included.

A. B. K.

TEXT-BOOK OF BOTANY: By Coulter, Barnes and Cowles. Vol. I. Mycology and Physiology. The American Book Co.

In this volume of 484 pages we have a strictly modern treatment of plant mycology and physiology eminently adapted to the needs of the university undergraduate. In the section on morphology, Dr. Coulter has given a much fuller discussion of the *Thallophyta*, *Bryophyta*, *Pteridophyta*, and *Spermatophyta* than is to be found in the average botanical text-book, and as a result of the greater number of types considered, the student gains a far more connected and broader view of the plant world, and a more correct idea of the evolutionary path. A valuable feature of this section is the discussion of the *Cycadofilicales* and allied groups, which unite the *Pteridophyta* and the modern *Spermatophyta*. It is a great relief to find in this section original cuts, for

however much we may admire the "old masters" in botany when the same old figures have looked out upon us from generations of text-books, we have a smile of welcome for something fresh. At the end of the section is an excellent chapter on organic evolution, in which the various theories of evolution and mendelism are briefly but clearly treated. The section on physiology is one of the last pieces of work done by one of our greatest plant physiologists, having been written by Dr. Barnes very shortly before his death. All the functions of plants are dealt with from a physical and chemical standpoint, and vitalistic theories do not enter into the treatment at all. Diffusion and osmosis are fully discussed; also the chemical nature of plant food. Particularly commendable is the strict adherence to experimental data, all hypotheses being clearly indicated as such. The section is well illustrated with good diagrams. Volume II. will consist of plant ecology, by Dr. Cowles, and will appear shortly.

A. B. K.

TEXT-BOOK OF BOTANY: By Coulter, Barnes and Cowles. Vol. II. Ecology. (American Book Company.)

This volume, by Dr. Cowles, on Ecology, treats the morphological and physiological phases of the subject fully, but devotes only eight pages to the physiographic aspect, which is a decided disappointment to those of us who know the author as a past-master in this latter part of the subject. The reason for this method of treatment is explained by Dr. Cowles as follows:—"Since ecology overlaps various sciences, it is less a single science than a science complex; its adequate study presupposes a foundation in the basic principles of physics, chemistry, morphology, and physiology, and, in the case of physiographic ecology, of taxonomy, physiography, geology, and meteorology as well. Partly because of its complexity, and partly because of its imperfect organization, it is impossible to present all its materials, even in elementary fashion, within the compass of such a book as this." Perhaps the outstanding feature of the book is the absolute avoidance of teleological explanations and terms, and we are in hearty accordance with the author when he says:—"It is not unreasonable to suppose that plants have many useless organs and characters, which are mere by-products of their fundamental activities." The material is grouped upon the basis of structure, the chapters dealing successively with Roots and

Plizoids, Leaves, Stems and Reproductive Organs. The cuts are numerous and excellent. The book will prove extremely valuable for class use in relating anatomy, physiology and external factors to one another.

A. B. K.

AN ECOLOGICAL SURVEY OF ISLE ROYALE, LAKE SUPERIOR. Prepared under the direction of Chas. C. Adams.

This volume is of great interest because it is, as far as we know, the first report ever published dealing with the entire biota of a region from an ecological standpoint. The field-work was done in 1905 by the following party :—Dr. Chas. C. Adams, Dr. P. A. Brown, Dr. H. A. Gleason, N. A. Wood, W. P. Holt, Otto McCreary, and Max M. Peet. The plan of the survey was for each member to collect and make ecological observations upon some particular branch of the biota, and on the return of the party many of the extensive collections were turned over to specialists in the various groups. Some idea of the scope of the work may be gathered from the titles of the papers which make up the report :—"Isle Royale as a Biotic Environment," by Dr. Adams ; "The Ecological Relations of the Invertebrate Fauna," by Dr. Gleason ; "The Ecological Distribution of the Birds," by Otto McCreary ; "The Fall Migration of Birds at Washington Harbour," by Max M. Peet ; "The Ecological Succession of Birds," by Dr. Adams ; "The Coleopteras," by Dr. Adams ; "Notes on the Vegetation," by W. P. Holt ; "Annotations on Certain Isle Royale Invertebrates," by Dr. Adams ; "Annotated List of the Mollusca," by Bryant Walker ; "Report on the Orthopteras," by A. P. Morse ; "Dipteras," by J. S. Hine ; "Annotated List of Hymenopteras," by E. G. Titus ; "The Arts," by W. M. Wheeler ; "The Cold-blooded Vertebrates," by A. G. Ruthven ; "Annotated List of the Birds," by Max M. Peek ; and "Notes on the Mammals and their Ecological Relations," by Dr. Adams. Particularly interesting is Part II. of Dr. Adams' "Isle Royale as a Biotic Environment," in which he summarizes the biota of the different "stations" at which work was done. In the same paper he gives the geological history of Isle Royale and of the Great Lakes. Numerous excellent photographs of the various environments are incorporated. This report is of particular interest to Ontario naturalists, on account of the close proximity of Isle Royale to Ontario.

A. B. K.

NEW ENGLAND TREES IN WINTER : By A. P. Blakeslee and C. D. Jarvis. Bulletin No. 69. Storrs Agr. Ex. Stn., Storrs, Conn.

The authors of this bulletin are to be congratulated on having produced a very useful work. In it keys, based upon the twigs and bark, are given to all the New England trees, both native and introduced. An excellent feature of this bulletin is the fine group of photographs illustrating the habit (in winter), the bark, the twigs, and, when it is persistent into the winter, the fruit of each species. Facing each group of photographs, which occupies a full page, is a description of the tree under the headings :—Habit, Bark, Twigs, Leaf-scars, Buds, Fruit, Comparisons (*i.e.*, with trees, for which it might be mistaken), Distribution (general distribution, distribution in New England and in Connecticut), and Wood (giving its properties and uses).

A. B. K.

PLANT LIFE AND EVOLUTION : By D. H. Campbell. New York. Henry Holt & Co.

This is a book of much interest, not only to the botanist, but to the general reader, as it tells in language as untechnical as is consistent with accuracy the facts and the theories concerning the evolution of plant life. The first part of the work gives a survey of the vegetable kingdom, from the bacteria to the seed-plants, and points out the various types which represent, as it were, milestones along the evolutionary path. The last part is taken up with the discussion of such topics as "Environment and Adaptation," the "Problems of Plant Distribution," and the "Origin of Species." Under this last head is given a very lucid, though brief, survey of Lamarckism, Natural Selection, Orthogenesis, and Mutation, and it is interesting to note that the author is of the opinion that "no one of the many theories that have been advanced can explain satisfactorily all the phenomena associated with the evolution of the vegetable kingdom." The author continually presses home the idea of the plasticity of plants and of the influence of the environment upon them. Altogether, the book is a modern, sane, and broad-minded exposition of the subjects with which it deals.

A. B. K.

FIRST COURSE IN BIOLOGY : By S. H. Bailey and Walter M. Coleman. Toronto. The MacMillan Co. of Canada, Ltd.

This work, which is admirably suited for use in high schools, consists of three parts: Plant Biology, by L. H. Bailey, and Animal Biology and Human Biology, by W. M. Coleman. The point of view from which the book is written is excellent, and is expressed in the sentences:—"The value of biology lies in the work with the actual things themselves"; "The teacher should not be afraid to make all teaching useful and practical." The section on Plant Biology is thoroughly modern, dealing in simple terms with variation, natural selection, plant societies, root-nodules of the Leguminosae, besides a full treatment of the general phenomena of plant life. In the section on Animal Biology, the treatment accorded Hydra, the Earthworm, the Insects and the Frog is excellent. The treatment of the birds is uneven; there are many good features in it, such as the statements regarding the usefulness of birds of prey and woodpeckers, and the food habits of various species; but there is little use in giving a key to orders named "Messengers," "Gorgers," "Robbers," etc., and thus teaching a classification which will only have to be unlearned before any further steps in bird-study are taken by the student. It is also a pity that the illustrations of birds and mammals are largely of foreign species, as it is high time that our texts dealt with our own North American forms, and included only such non-indigenous species as the monkeys, when these are needed for comparison. The need for more careful treatment of our native forms is shown by the mixing up of the Lynx and the Wild Cat, and the figuring of "*Lynx rufus*" with long terminal pencils on the ears. The section on Physiology is full, and sane hygiene is introduced at every opportunity. We are particularly glad to see the caution against the use of "infallible drugs advertised in the newspapers, even if recommended by otherwise intelligent people."

A. B. K.

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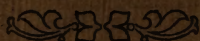
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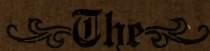
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